Published 1916 as
OIL WEEKLY

WORLD OIL

SPECIALIZED FOR EXPLORATION, DRILLING, PRODUCING,
PIPE LINE OPERATIONS AND MANAGEMENT

JUNE, 1953

• For a new idea on tubing pressure gradients . . . read Production Section

Subscription Price $2 Per Year
Price This Copy 50 Cents

UNIV. OF MICHIGAN
JUN 8 1953
EAST ENGINEERING
LIBRARY

PICKED FOR OUTSTANDING PERFORMANCE

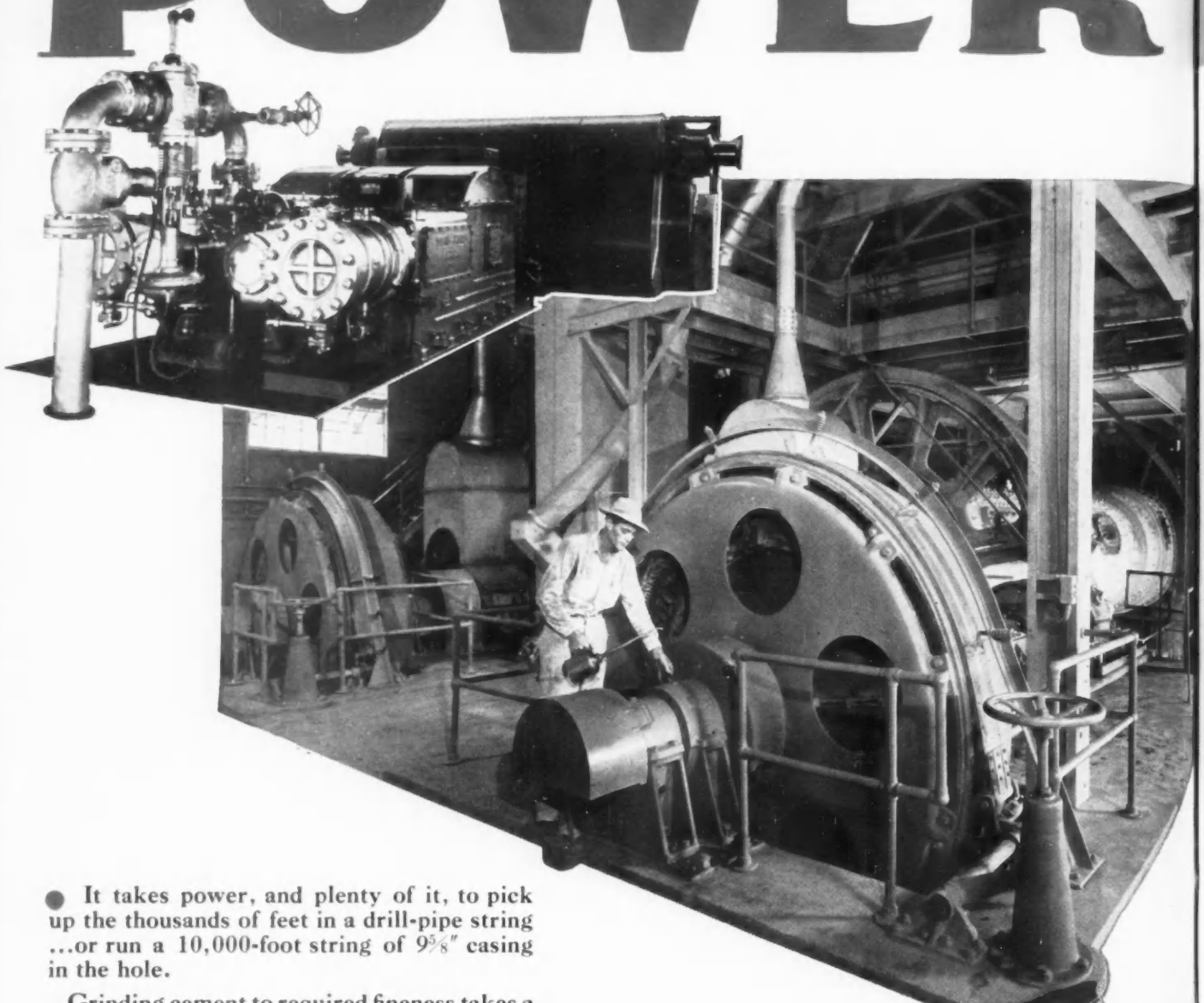
More operators use OSC Series bits than any other to drill soft, unconsolidated, broken and medium rock formations. And for one reason only — *performance* . . . higher penetration rate, straighter hole, and increased footage per bit.

Today's OSC Series bits are the product of more than 40 years of field and research experience. Hundreds of designs were tested, and the performance of millions of bits in thousands of wells studied in developing the shape and length of the teeth, the proper ventilation of the heel teeth to shed formation faster, and the correct twisting, tearing action on bottom. The result — bits that excavate more formation per revolution with lighter weight.

The same field experience and painstaking research goes into every HUGHES rock bit to assure maximum performance . . . and lowest possible drilling costs.

Hughes OSC Series bits (OSC, OSC-1, OSC-3) are used in oil fields throughout the world.

POWER



● It takes power, and plenty of it, to pick up the thousands of feet in a drill-pipe string ...or run a 10,000-foot string of 9⅝″ casing in the hole.

Grinding cement to required fineness takes a lot of horsepower, too. This finish mill (shown at right) is a steel cylinder 9′-6″ in diameter by 40′ in length, weighing 285,000 lbs., charged with 165,000 lbs. of steel balls . . . making a total load of 450,000 lbs. A 1000-horsepower electric motor spins this loaded cylinder at 24 revolutions per minute, in producing 600 sacks of cement an hour — quality cement, made to meet the exacting demands of the Oil Industry.

LONE STAR CEMENT CORPORATION

Offices: DALLAS • HOUSTON • ABILENE, TEX. NEW ORLEANS • BIRMINGHAM • KANSAS CITY, MO. ALBANY, N. Y. • BETHLEHEM, PA. • BOSTON • CHICAGO INDIANAPOLIS • NEW YORK • NORFOLK • PHILADELPHIA RICHMOND • ST. LOUIS • WASHINGTON, D. C.

SELECT CEMENT TO FIT THE JOB

WORLD OIL

Established 1916 as The OIL WEEKLY®

Turn the page for quick guide to the articles in this issue.

June, 1953 **Volume 136, No. 7**

RAY L. DUDLEY, President, Publisher
A. L. BURNS, General Manager
WARREN L. BAKER, Editorial Director

EDITORIAL STAFF
WARREN L. BAKER, Editor
AL REESE, Managing Editor
L. J. LOGAN, Associate Editor
CECIL W. SMITH, Statistical Editor
J. E. KASTROP, Production Editor
PHILIP L. McLAUGHLIN, Drilling Editor
DONALD M. TAYLOR, Pipe Line Editor
DON KLIEWER, International Editor
WALLACE FITZGERALD, Assistant to Managing Editor

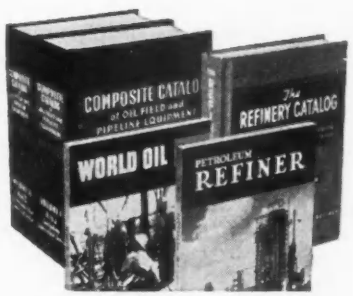
DISTRICT EDITORS
ROBERT E. SPANN, 250 Park Ave., New York 17, N. Y.
GILBERT M. WILSON, W. W. Wilson Bldg., Huntington Park, Calif.
ANTHONY GIBBON, Hunt Bldg., Tulsa 3, Okla.
MARY STUART WARREN, THERESA K. MARTIN, DARLENE LYONS, Editorial Assistants
LEVA A. MALCOLMSON, Librarian

ADVERTISING STAFF
TOM W. NELSON, Advertising Manager
NELSON BIGELOW, GENE HART
250 Park Ave., New York 17, N. Y.
BILL WESTFALL, 1010 Euclid Ave., Cleveland 15, Ohio
H. G. FITZPATRICK, MARTIN HALLORAN, 332 S. Michigan Ave., Chicago 14, Ill.
BILL ATCHESON, Hunt Bldg., Tulsa 3, Okla.
J. W. CURTS, W. W. Wilson Bldg., Huntington Park, Calif.
CHARLES WYATT, CLAIR BRYAN, JR., 3301 Buffalo Drive, Houston 6, Texas
D. S. CRAIG, Mgr. Advertising Service Dept.

CIRCULATION DEPARTMENT
R. M. DE SOMBRE, Manager

Single copies 50 cents (except special issues). Subscription price: domestic and foreign, $2 a year; 2 years, $3; 3 years, $4. WORLD OIL, published every month except semi-monthly in February and August. Entered as *The Oil Weekly* as second class mail matter December 23, 1916, at the post office at Houston, Texas, under the act of March 3, 1879. Advertising rates on application. Copyright, 1953, by The Gulf Publishing Company.

Indexed by Industrial Arts Index and Engineering Index



Specialized Oil Publications of
THE GULF PUBLISHING COMPANY
3301 Buffalo Drive, Houston 6, Texas
Box 2608, Houston 1, Texas
WORLD OIL and The COMPOSITE CATALOG for the drilling-producing-pipe line industry
PETROLEUM REFINER and The REFINERY CATALOG for the refining-natural gasoline-petrochemical industry

CURRENT OUTLOOK SECTION

Looking Ahead ... 39
Editor's Page ... Warren L. Baker ... 41
This Is the Oil Show ... 42
57 Million Pounds of Explosives Used in 1952 U. S. Seismograph Activity ... Don Kliewer ... 45
When the Big Winds Blow ... Al Reese and Robert E. Spann ... 48
Offshore Development To Be Speeded Up ... L. J. Logan ... 53
Industry Safety Record Best in History ... Staff Article ... 59
Changing Panorama ... 60
Report From the Observatory ... Ray L. Dudley and Warren L. Baker ... 64
Petroleum Trends in the U. S. ... Cecil W. Smith ... 66
News Analysis ... 68
The Big Moment . . . for E. DeGolyer ... Staff Article ... 70
Iran Supplies Some Answers ... Staff Article ... 72
The Month's Completions ... 74

EXPLORATION SECTION

Mississippi's Black Warrior Basin Yields Gas-Condensate (Part 1) ... Frederic F. Mellen ... 77
What Are the Possibilities in Beaver County, Oklahoma? ... Wayne H. Grimes ... 84
Increase in Activity Sends Exploratory Completions Up ... Cecil W. Smith ... 97
U. S. Discoveries in April ... 98

DRILLING SECTION

Ohio's Slim Hole Rig Cuts Exploratory Drilling Costs ... Gerald Burgess and H. D. Hoopman ... 107
Is This the Answer to Offshore Drilling? ... 116
New Vacuum-Type Degasser Reduces Deep Drilling Hazards ... R. W. (Woody) Erwin ... 125
Procedures to Be Used in Fighting Lost Circulation (Part 2) ... J. M. Bigbee ... 132
It's Easy to Get Hurt! ... 143
World Oil Graphics: Suction Hose Care ... 144
Drilling Hints ... 146

PRODUCTION SECTION

New Correlation Simplifies Pressure Gradient Calculation In Tubing ... Fred H. Poettmann and Paul G. Carpenter ... 161
Little Bugs . . . Big Problems in Oil Field Waters ... Dr. O. B. Williams ... 170
Magnolia Makes Unusual Completion in Wilcox ... J. E. Kastrop ... 176
Use of Existing Tubing Cuts Workover Costs ... E. O. Stewart and Henry Priesmeyer ... 186
Some Answers to Oil Field Scale and Corrosion ... E. N. Frisius ... 191
Production Hints ... 197

PIPE LINE SECTION

New Flowmeter Measures True Mass-Rate ... Y. T. Li and P. A. Lapp ... 215
Map of the Month: Buckeye Pipe Line Company ... 220
Perils of Pipe Line Pete ... 222
Rules of Thumb for Pipeliner's Notebook ... 225
Pipe Line Construction ... Theresa K. Martin ... 228
Pipe Line Hints ... 234

INTERNATIONAL SECTION

Cuban Exploration Travels South ... Dr. Albert Ruschil de la Roche ... 243
Kingdoms of Oil: Osage County, Okla. ... Clarence F. Mantooth ... 247
Of World Oil Men ... 256
A WORLD of OIL ... Don Kliewer ... 258

NEW EQUIPMENT SECTION

For More Information on Products Advertised ... 275
Reader Service Postcards ... 275
New and Improved Equipment ... 277
Other New and Improved Equipment ... 279
New Literature ... 282
New Catalogs and Equipment Literature in Advertisements ... 284

DEPARTMENTS

Readers' Guide ... 2
Advertiser's Index ... 6
Who's Meeting Where ... 36
News of Men in the Industry ... 285
Companies in the News ... 292
Association News ... 295
News of Service and Suppliers ... 300
Trading Post ... 320
New Books, Maps and Movies ... 321
Squeaks from the Bullwheel ... 322

A Quick Guide to

WORLD OIL this month . . . .

• Current Outlook

☐ **What's the outlook for crude oil prices in 1953?** Total demand for all oil? Industry earnings? What's happening in the Williston Basin? For the answers to these and other questions, see *Looking Ahead,* **Page 39.**

☐ **Costs can be cut.** The net income of many oil companies was less in 1952 than in 1951 despite larger retail sales and peak producing and refining volumes. Industry is aware that soaring operating costs played a big part in this. But there's a trend that is encouraging. See the *Editor's Page,* **Page 41.**

☐ **A spectacle? Yes!** WORLD OIL went to the International Petroleum Exposition at Tulsa and got the inside from an "outsider." For his impressions, see **Page 42.**

☐ **Seismograph exploration boomed during 1952 . . .** more than 57 million pounds of explosives was used . . . 7.9 percent of the total U. S. production for the year and worth itself more than $16 million. And there's millions more involved. See **Page 45.**

☐ **Tropical storms that never hit** the Gulf Coast have cost the oil industry more money than those that did. The reason? Inadequate pinpointing of the big winds that prowl the Gulf from mid-June until October, forcing unnecessary or premature shutdowns. This is the first of a two-part world-wide roundup on precautions taken by the oil industry to assure maximum efficiency and safety during storm threats. **Page 48.**

☐ **Eisenhower kept a promise . . .** and the tidelands bill is now law. Long delayed development of submerged lands off U. S. coasts is due to be stepped up. For a review of the situation, see **Page 53.**

☐ **The industry is safer now,** according to the annual survey of accident statistics compiled by the API. The accident frequency rate for all branches was the lowest in history, and this despite the fact that operations and employment levels reached new peaks last year. Particularly significant were the safety gains made in the drilling division, most hazardous in the industry. **Page 59.**

☐ **How much oil is Iran producing?** How many wells are contemplated? What is the status of the Abadan refinery? To find the answers to these questions and many others, WORLD OIL went direct to the managing director of the nation's recent nationalized oil business and got the facts. See **Page 72.**

• Exploration

☐ **The Black Warrior Basin is bustling.** This petroliferous province is assuming greater importance to the operator as well as others in the industry. The outlay for drilling in the area during 1952 far exceeded any past year. Here's an article that provides an interesting and useful array of information by a man who has studied and worked the area for many years. **Page 77.**

☐ **A new oil province in Oklahoma**—Beaver County. Discovery last year of the first reef-type production in Oklahoma and recent discoveries indicating existence of important oil structures have focused attention on the area. The article beginning on **Page 84** describes the possibilities for oil and gas development and presents a concise report of a detailed subsurface study of the area.

Use this condensed information on this month's principal articles. Run through these digests rapidly. ✓ Check those you want to read first.

• Drilling

☐ **Exploratory drilling costs cut.** How? The Ohio Oil Company has assembled a slim hole drilling rig which promises to cut expenses in half. By using a small, light rig and drilling a smaller hole costs are cut down the line. It is not the contention, the authors say, that the small bore drilling will replace heavy rigs for wildcatting, but it is felt that hundreds of thousands of dollars can be saved annually through use of these tools. See **Page 107.**

☐ **Is this the answer to offshore operations?** The simple mechanical principle by which a boy shinnies up a tree has been put to work in a complex jack arrangement that lifts a 5½ million-pound barge 100 feet in the air. It may change the concept of offshore operations. **Page 116.**

☐ **Everybody likes to talk about his job.** This is the key to the safety-promoting technique of having men remind themselves of their job hazards. The method was demonstrated in a panel discussion at the Annual Drilling Industry Safety Clinic in April. WORLD OIL recorded the discussion and offers it as a practical method of reducing accidents. **Page 118.**

☐ **Lost circulation and blowout dangers** can be controlled in close balanced systems. That's what the performance of a new vacuum-type degasser indicates. Holes have been saved in areas where successful completions were not known. All this by complete removal of entrained gases in gas-cut muds. For a description of performance and the advantages, see **Page 125.**

☐ **How to combat lost circulation.** When the analysis of the lost circulation problem at a given location has proceeded through the review nature of zone and pressure conditions, a procedure or sequence of procedures best suited to the problem should be selected. The conclusion of a two-part article starts on **Page 132.**

☐ **It's Easy to Get Hurt!** Carelessness, not hazards, causes most accidents. Everybody knows this; few remember it. This is the first of a series of pictorial safety messages taken directly from the records of companies in the industry. We invite you to clip them. Put them on your bulletin board. Pound home the warning that it's easy to get hurt! **Page 143.**

☐ **Make your suction hose last longer** with a shop-made nipple offset flanged to the valve. Misalignment is corrected and it allows a straighter run for the hose. See WORLD OIL Graphics, **Page 144.**

☐ **An answer to the problem of frozen mud** collecting in pulled drill pipe is the use of a specially-designed base through which steam can be circulated during freezing weather. This and other time-saving items are described in the Drilling Hints. **Page 146.**

• Production

☐ **Higher efficiencies in producing wells,** and particularly gas lift installations, are realized by knowing the pressure gradient in the tubing. A new correlation, which is relatively simple and considerably more accurate, uses several basic curves from which to predict these gradients from surface data. It was derived from actual field data on 49 wells. In addition to pertinent curves and tables and instructions which tell how to use the new correlation, the mathematic derivation is presented in *New Correlation Simplifies Pressure Gradient Calculations in Tubing,* **Page 161.**

☐ **Little bugs can be big problems . . .** in oil field waters. Microscopic cells that are abundant in nature and thrive in the absence of free-oxygen can cause plugging in salt water injection and disposal

operations. What they are . . . how they live . . . and what can be done about them is described in an article starting on **Page 170.**

☐ **A wild well turned into commercial producer.** That's what Magnolia did with its deepest Wilcox producer. It was accomplished by some quick thinking and unorthodox hookups. It was probably the only well with a christmas tree some 150 feet from the well. For the story on circumstances leading up to this unusual well and how the feat was done, turn to **Page 176.**

☐ **Troubled with expensive workovers?** Here are some pointers on reducing costs. By simply using the tubing existing in wells to be repaired, considerable saving in workover expense can be made. This practice is general on Gulf Coast where external upset tubing, when found in good condition, has been used widely for working over pumping wells safely and economically. How it's done and the advantages are described on **Page 186.**

☐ **Some answers to corrosion questions . . .** If scale or corrosion is eating up your profit, this may offer some practical solution to your problem. Engineered applications of proper inhibitors will save money. Before-and-after case histories back this up. What causes various types of scale and corrosion? What methods should be used to combat them? See **Page 191.**

☐ **Traps to aid in cleaning salt water gathering lines** are one of the devices recommended in this month's Production Hints as a successful method of operation. Shop-made ladders to make checking of equipment less hazardous and a time-saving method of anchoring a newly-installed pumping unit are some of the other topics described. **Page 197.**

● Pipe Line

☐ **A new flowmeter has been developed** that measures the actual mass of liquid carried past it per unit of time. It is linear, bidirectional and has a rapid response. It can be calibrated without passing liquid through it and is independent of any physical properties of the flowing liquid. For details of this newest scientific advancement, see **Page 215.**

☐ **Map of the month.** The origin of Buckeye Pipe Line Company dates back almost to the beginning of pipe line transportation. Sixty-seven years old and still growing is its boast. This fall the company will put into operation the final spread of its most recent expansion project, the 370-mile, $24 million Eastern Products Pipe Line System. Story and map, **Page 220.**

☐ **WORLD OIL's monthly pipe line features:**

- Perils of Pipe Line Pete, **Page 222.**
- Rules of Thumb for the Pipeliner's Notebook, **Page 225.**
- Pipe Line Construction, **Page 228.**

● International

☐ **Cuban exploration travels south.** Every Cuban province has oil and gas seepages. They have led to the discovery of three producing fields in the north. Now the most promising areas are those in the south and central portion of Habana Province. Exploration is scheduled there by United States-Cuba Oil and Drilling Corporation. For geologic details, see **Page 243.**

☐ **Another kingdom from oil history**—the story of the Osage Indians of Oklahoma is one of poverty and riches. It was oil that made the difference. Walking with want until 1897, they rode with wealth from then until the production of crude from vast reservoirs beneath their nation waned. But now history may repeat . . . with the aid of modern secondary recovery operations. **Page 247.**

☐ **Portugal's first commercial crude production** may be indicated with the discovery of a slight oil showing near Lisbon in a shallow test. The interest is high enough that the Portugal government and a Swiss company are going to drill a deep well at the same site. See **Page 274.**

Looking Ahead

Crude oil prices to remain unchanged. That's the outlook for 1953. Industry executives say growing surplus of producing capacity will prevent price spurts. But normal increase in demand for petroleum products will keep markets firm and prices steady.

Total demand for all oils in 1953 will be about 5 percent above 1952. For first quarter it was 4.6 percent above last year, with motor fuel demand up 7 percent.

Oil industry earnings in 1953 probably will be about same as in 1952. Sales and revenues will be higher, but costs and expenses also will be up. Some oil concerns showed slightly higher first quarter earnings in '53 than in '52. But others showed decreases. Industry as a whole showed a decline of about 2 or 3 percent.

New and deeper pay zones for Williston Basin are an early possibility. Amerada Petroleum Corporation well in Beaver Lodge field will test deepest potential producing horizon. Company has 125 producing wells in basin, and says its two discoveries—Beaver Lodge and Tioga—are fields of "great significance."

Petroleum is crowding public utilities for third place among U.S. businesses. The standings: agriculture $170 billion investment; public utilities, $52 billion, and petroleum, $43 billion.

"Probably far too low," says Dr. Gustav Egloff of estimates of ultimate oil reserves of 1500 billion barrels for world and 120 billion for U.S.

Aluminum production continues to expand. By late 1953, civilian demand can be met unless military and stockpile needs exceed estimates.

Insecticides made from petroleum eventually will eliminate annual loss of $4 billion now suffered by farmers.

Britain soon will be virtually independent of refined product imports. Importing an increasing volume of Middle East crude, at low cost in dollars, Britain will become substantial exporter of products. In 1952, British exports of principal refined products were twice those of 1951.

Pipe line construction in 1953 will top record-breaking 1952. Present capacities include 7 million barrels per day for crude and 1½ million for products.

Underground cavities can store 8½ million barrels of liquefied petroleum gases by early 1954, compared with 225,000 barrels in 1950. But greater expansion of underground storage capacity is needed, especially in consuming areas, to meet peak seasonal demand. Similar storage is needed for natural gasoline.

SANDFRAC* CAN BE TAILORED TO FIT FORMATION TRAITS

Sandfrac by DOWELL provides effective fracturing in formations having low solubility

*SANDFRAC—a service mark of Dowell Incorporated

Sandfrac is one of the methods developed by Dowell to fracture low-solubility formations. It is a versatile fracturing service. The special refined oils and propping agents used in Sandfrac can be tailored to fit the characteristics of almost any well.

The sands used in Sandfrac treatments are available in several sizes. To make this service even more effective, Mud Acid is frequently used before a Sandfrac treatment to lower the pressure in a tight formation.

Perhaps a Sandfrac treatment can make your marginal wells into good producers as it has for other operators.

Here are some examples of the results of Sandfrac treatments performed by Dowell:

Production from a well in a sand formation was increased from 6 to 288 BOPD; another well in a sand formation went from a show to 336 BOPD; and a well completed in a conglomerate formation went from a show to 672 BOPD.

Call the Dowell station nearest you. Ask for the facts on Sandfrac. An experienced engineer will be glad to call on you to discuss this or any of the many other oil field services made available to you by Dowell. However, if you prefer, you can write directly to Tulsa, Dept. F-13.

DOWELL SERVICE

Acidizing • Fracturing • Electric Pilot • Perfojet
Paraffin Solvents • Jelflake® • Bulk Inhibited Acid
Chemical Cleaning for Heat Exchange Equipment.

DOWELL INCORPORATED • TULSA 1, OKLAHOMA
A Subsidiary of The Dow Chemical Company
"First in Oilfield Acidizing . . . Since 1932"

Look to DOWELL
FOR OIL INDUSTRY CHEMICAL SERVICE

Costs Can Be Cut

THE NET INCOME of many oil companies was less in 1952 than in 1951. This was true although larger retail sales and peak producing and refining volumes created record gross revenues. This situation existed because the cost of doing business hit an all-time peak, thereby cutting heavily into profits. This trend toward decreased earning power must be checked and turned in the other direction.

High taxes, it is true, are an exceedingly important factor tending to reduce net profits despite larger income. However, other factors also enter the picture in a big way. Higher operating costs are an equally important problem. The cost of leases, drilling and all other operations are far greater than ever before.

Consequently, the oil business probably never has been so cost conscious as it is today. The problem is being discussed everywhere one goes. Many companies, both large and small, already are making a concentrated effort to find means of reducing costs. No doubt others soon will be taking a serious look at the situation.

At the moment the chief interest seems to lie in discovery costs. This is not surprising, for the cost of finding and developing new oil fields has reached an extremely high plane. This phase of the industry has experienced a sharper rise in costs than other activities, making reductions a necessity. However, other operations also are coming in for study.

• • •

IT IS WELL that an increasing number of companies and operators realize the need to study their costs. The realization that ways and means must be found to reduce costs is a healthy condition. It will result in widespread concentrated studies which will lead to constructive developments. Not only will general efficiency be improved, but technological improvements will be stimulated to an extent real reductions can be achieved in drilling and producing costs.

In the long run, gains in efficiency and improved operations will enable the industry to limit the decrease in earning power to moderate proportions. This will permit the industry to continue its expansion and growth.

Warren L. Baker

You enter the grounds. To your right the Nomads' building . . . down Drake Drive . . . derricks towering into sky. The crowds are tremendous. A spectacle? Yes . . . but . . .

This Is the Oil Show

World Oil asked a man attending the International Petroleum Exposition from "outside" to write his impressions, so that fellow oil men not attending the show could know what it was like. These are his impressions, presented anonymously at the writer's request.

•

No sooner had I stepped within the gates of the International Petroleum Exposition in Tulsa than I realized that I was in the midst of one of the biggest things in the world. My second feeling was one of great pride in being a part, even if only a small part, of an industry which supports such a tremendous spectacle.

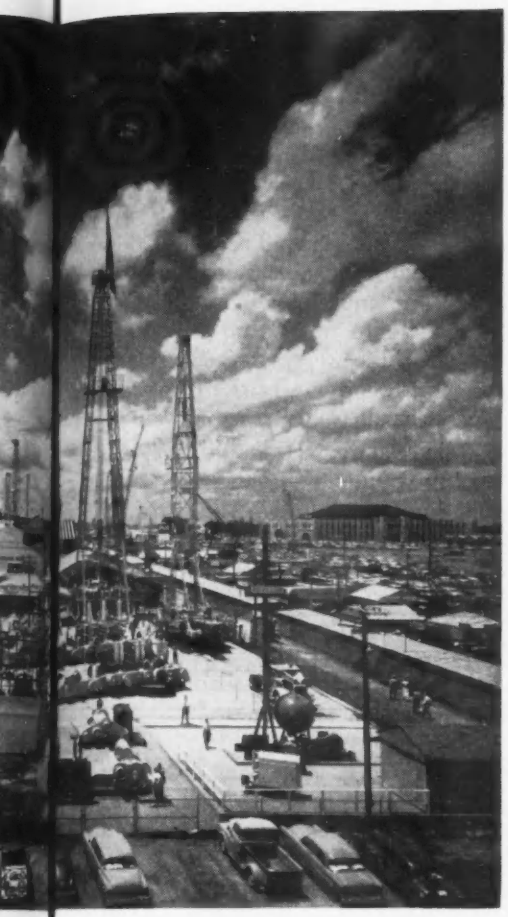
For that is what first meets the eye—a spectacle such as no other industry could possibly stage. Expenditures on the exhibits of individual equipment or supply companies dwarfed the exhibits of powerful nations I had seen previously in World Expositions. It needed no prodding to drive home the story that here on these grounds manufacturers of equipment used by the oil industry had spent more than ten millions of dollars, to demonstrate literally scores and scores of millions of dollars worth of their products.

A spectacle of spectacles? Yes.

But as I paused I saw what a non-oil man might have overlooked. Here was not a gaudy display of wealth . . . no, here in actual demonstration were the thousands of pieces of equipment and types of service which have helped to transform the oil industry from a rule of thumb affair, into its position of first industrial rank in the world. And then the realization, too, of how the teamwork of the manufacturer with the men in the oil business have lifted it into one of the most scientific endeavors known to man.

Superlatives? Yes! But deservedly so.

When I was asked by World Oil to write my impressions and experiences at the "Oil Show," I glibly accepted, so that "the boys back home"



Far left is a view down Drake drive from main entrance of International Petroleum Exposition in Tulsa. Right is a general view from east end showing vast area covered by grounds.

could share these impressions. Then when I first walked through the grounds—when I first started to walk through, I realized how puny was my ability to describe it.

New Buildings. For those of you who have been to oil shows previously, the principal difference between this year's show and previous ones, lies in new buildings put up by exhibitors, of which there are many . . . the completeness of outdoor exhibits, on which the space seems to have been expanded . . . and in the handling of exhibits within the main exhibition buildings.

For those who have never attended an oil show, you may enter the grounds at a point just in front of Exposition Headquarters. To your immediate right is the Nomads' building, where visitors from outside the U. S. A. are registered, and made to feel at home. Every possible attention is paid to such visitors of whom there were many. The first street you see is, most appropriately, Drake Drive. Incidentally the walkways and driveways throughout the 28-acre grounds are named after important oil fields, oil states, with a few exceptions about which you wonder. Derricks tower high into the heavens, both the stationary and the jack-knifing variety. Hanging over Drake Drive is an immense flag. As I said earlier some of the buildings housing exhibits of manufacturers or supply companies represent extraordinarily heavy investment, some of them running into the hundreds of thousands of dollars. It seems as though hundreds of rigs are running.

The main exhibition buildings, Texas, Oklahoma, Kansas, California, Technical, Refiners and Marketers, Hall of Science, are immense, long corrugated iron buildings with ventilation at the top. Exhibits in these buildings are in booths, the exhibits ranging from one booth 10 feet by 10 feet to as many as a dozen, possibly more per exhibitor. Each exhibit vies with the other in trying to attract the attention of the throngs which file by, stopping to see this or that.

Unlike the early days when train loads of crushed rock were being dumped into the muddy streets and walks while both show and rain were in progress, everything is now well paved. True, a rain will hold you in a building unless you brought a raincoat, but the buildings usually have enough in them so that you do not mind it too much. Maybe someday the Exposition will provide covered walkways between the main buildings.

Stucco fronts have been put on the main exhibition buildings so that Drake Drive presents a picture of gleaming white buildings fronting it.

Crowds Big. The crowds are tremendous for the size of the grounds. While the announced daily totals include a lot more people than visiting oil men, they all contribute to vast throngs, over 50,000 being reported one day. Sometimes it seemed to me that if the throngs contained only the people in the oil business, it would be better for all concerned, but I understand that this is a question on which a great deal of talking and even controversy has been engaged. Mingled in the crowd are women and children, principally from Tulsa, although I talked to several who were the wives and children of oil men working in points not far from Tulsa. The women, it must be said, seem almost as interested as the men. Tulsa is very proud of the show and Tulsa people, whether oil or not, visit it in large numbers. Not simply the oil men, but the townspeople of Tulsa ask you: "What do you think of the show? How does it compare with previous shows?"

It has been my privilege to attend several oil shows but the one about which I am writing eclipses them all by a very wide margin. Not only were there more exhibitors but there was a most noticeable improvement in the exhibits.

Probably the first impression was one of improved design in equipment. Never, at a previous show, have I seen what appears to me to be as great an improvement in design over previous years.

This year it seemed that there were more demonstrations of equipment under way. I think there may be some room for more improvement along this line but a big step was taken in the '53 show.

The din of roaring engines, of performing equipment was so great that you could close your eyes and easily imagine that you were on an actual oil operation. One minute you would see a derrick piercing the sky. You would turn around to talk to a friend, then turn back and look, and presto! It was gone!

Use of plastic models contributed greatly to the ease of understanding what was being shown. Actual working models in plastics were seen in many exhibits and I imagine that future shows will see more of this.

Portability and safety seem to be designed into more and more equipment. The use of modern science, electronics, chemistry, metallurgy and radiology (if that is the right word) has been called on extensively in equipment design—so much so that I wouldn't be surprised at the next Oil Show to see Buck Rogers in full space uniform demonstrating some "other world" gadget!

One thing which impressed me about the equipment was the continuing trend toward automatic operation, less and less dependence on the human eye and "feel" of the operator.

As I stood in a crowd watching an ultra-modern drilling rig perform, an

'. . . friendliness and organization make it best show ever . . .'

oldtimer, evidently from his conversation a drilling contractor and maybe an old time driller, was gazing interestedly at the control panel of the rig.

The panel was as complete and seemed complicated as that of a B-36, but the operator in a tin hat nonchalantly made the rig do everything but stand on its head. The oldtimer turned to someone standing by and murmured "That ain't the way we used to do it!"

Top Salesmen. And speaking of demonstrations, I think that the cream of oil equipment salesmen must have been skimmed off and brought to the Oil Show. When you ask questions you've got answers which you felt came with authority.

"You *must* have been impressed," you say. Well, frankly, I was.

I was impressed by the preparations which had been made by the exhibitors to acquaint me with the most modern oil equipment in the world and frankly, I was impressed by my own lack of preparation before attending.

A person to get all the good from this oil show to which he and his company are entitled by reason of the expense in coming and the expense incurred by the exhibitors, ought to plan his trips through this Exposition carefully. He ought to figure before coming what problems he has that equipment will help solve, and plan to see that particular equipment with all of its latest improvements. In fact, I think that an individual attending the show should have in his mind, and possibly in his pocket, two lists:

- One the list of the type of equipment he *must* see, if possible made out by names of manufacturers and
- Two a list of somewhat lesser important things he would like to see.

Then he should spend the rest of his time rambling through to view the multitude of equipment in which he might be interested.

I am no advertising man, but if I were a manufacturer I think I'd advertise in the oil papers *a couple of months ahead of the Exposition* the equipment I was going to show at the Exposition. This would give us boys from the outside time enough to make up our call lists before leaving home.

But, I must say, every method was to be found on the grounds to help the oilman get around and find what he wanted. The oil publications did that. WORLD OIL had a classified list of equipment exhibited in a pocket-sized booklet which enabled anyone checking on particular types of equipment to find what they wanted quickly without going all over the grounds looking for it. The booklet had a map of the grounds in it. *The Oil & Gas Journal* was distributing a map in color. *Petroleum Engineer* distributed a supplement from their magazine telling who was in attendance at each exhibit and giving the Tulsa address used as "housequarters" by the exhibitors. Reason for this was that most of the exhibitors were quartered out in private residences, leased for the purpose.

An Expert's View. I think that maybe an old friend of mine, known pretty well all over the world, Jack Berlin, described the situation accurately. Jack Berlin is head of the Production Department of Standard-Vacuum Oil Company and he summed it up this way to me:

"This is the best organized oil show I have ever seen and I have seen most of them. It is the best industrial exhibit I ever saw and I have seen a lot of them.

"We bring our men in here from as far away as Indonesia to see this modern equipment and we think it is well worth while.

"One thing I have noticed is the friendliness exhibited everywhere. Of course, there has always been friendliness between oilmen and their equipment and supply men, but the thing that struck me particularly at this oil show was the friendliness exhibited among the manufacturers themselves even though they might be tough competitors. They seemed to be perfectly willing to help a visiting oilman get around to see a competitor's product. This makes a fine impression on the oilman."

Then he complimented the way housing has been handled for this show and it is so great an improvement over previous years, that I have heard no complaints. The Tulsa people opened their homes in an unbelievable manner. You'd simply had to be there to see it and believe it. I'm told there were some exceptions, but most of those leasing private homes seemed well pleased.

Berlin mentioned something I had heard much about—how often the oil show should be held when he said, "I think this idea of a show is a great one if it is to be held once every four or five years. That would enable the exhibitors to put on a real show and the oil companies ought to cooperate to the fullest degree in sending their men to it from everywhere."

It Takes Time. And that brings up the question of how much time does a man need to see the show. Well, a friend of mine figured it this way:

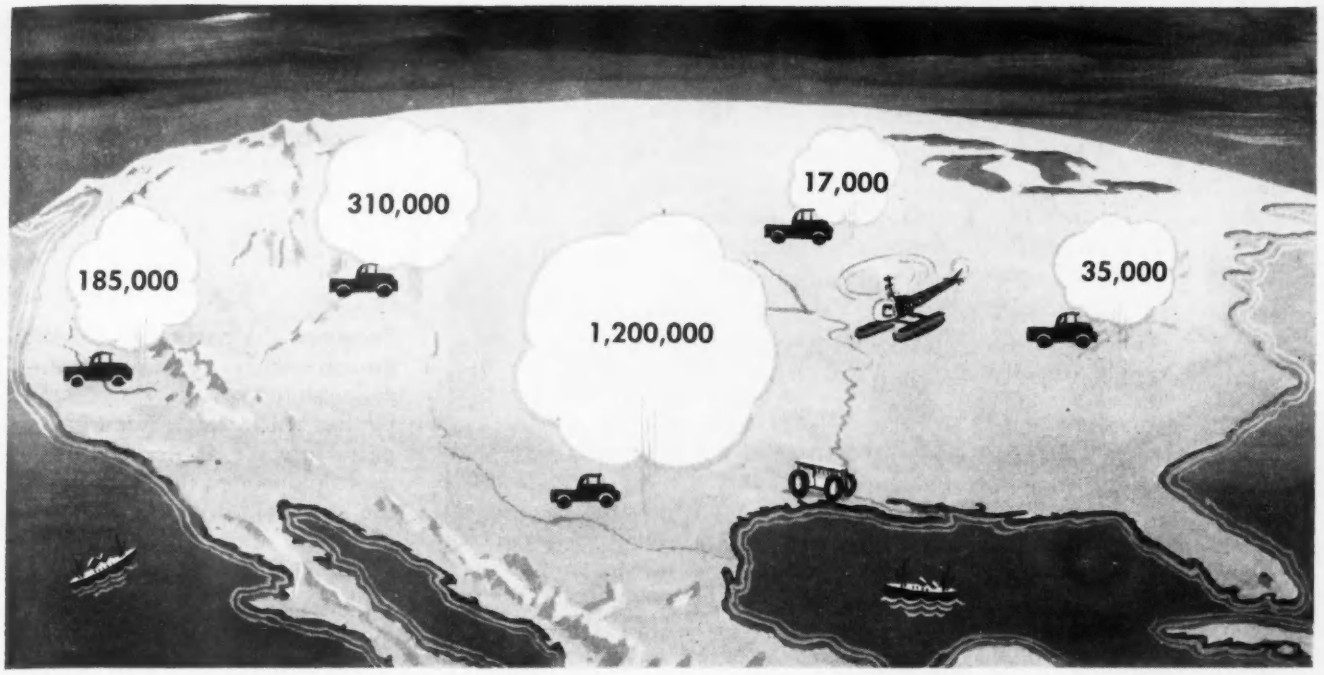
"There are more than 1400 exhibits. If a person saw a new exhibit every four minutes and worked 10 hours a day it would take him 10 days!"

Actually this is an exaggeration because, although there *are* 1400 exhibits, no one person would want to see all of them. That is why a person, to get the most good from the show, must plan his trips. But I do not see how a man can cover the oil show without spending at least four days. I spent a week and still didn't see all of it. Several oil companies worked out either simple or elaborate plans to help their men cover it. One company that I know of got out a booklet for its men.

Though it rained at times several days during the show, one could say that the weather was satisfactory. It was cool during the week I was there.

Tulsa was blooming with flowers. The climbing roses were a joy to a lot of us. Tulsa meals were good, service in an excellent cafeteria on the grounds was fine. Taxicab service, police handling of traffic was excellent.

What about bringing your wives? Man, are you crazy! This is a business deal. Leave her with the kinfolks!



How much and where explosives used in U. S. in 1952.

Oil exploration boomed during 1952. Seismograph activity was at a peak. Busy crews used some 344,421,000 feet of wire leads, thousands of detonating caps . . . and . . .

57 Million Pounds of Explosives

By DON KLIEWER, WORLD OIL Staff

When a seismograph crew late in the afternoon of December 31, last year, detonated an explosive charge in Terrebonne Parish, Louisiana, the last ten pounds out of 57,403,000 pounds of explosives had gone "BOOM" in the 1952 effort to find oil by seismograph means alone. And along with the more than 57 million pounds of explosives, there had been used for the same purpose 344,421,000 feet, or 65,000 miles of wire leads and enough detonating caps to fill bushel baskets from here to there—$3,228,000 worth, to be more specific.

This 57 million pounds of explosives represents 7.9 percent of the total produced in the U. S. in 1952 and is itself a $16,073,000 hunk of business. Incidentally, it is only a part of the money spent for explosives by the oil industry.

By way of adding the information on how successfully all of this explosive was exploded, 179 new fields were added by geophysical methods, most of them seismograph, last year, resulting from seismic operations in previous years.

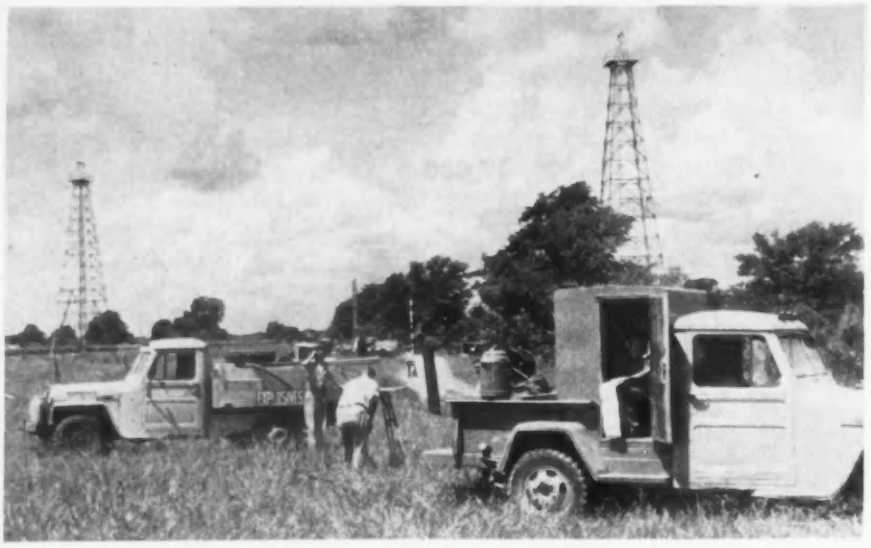
To conduct this vast operation, seismograph crews—averaging a dozen men each—prod themselves and their equipment—ranging from an average of $60,000 to $75,000 per crew—along at a pace equivalent to about 428,000 miles a year.

Big Business, any way you look at it. Big because it takes a giant to catch a giant.

Into this effort go more than 1.5 million crew hours annually. In 1952, 7958 crew months were calculated (World Oil, April, 1953) by Dr. E. A. Eckhardt, Gulf Research and Development Company and head of the Committee on Geophysical Activity. Generally, a crew month contains between 205 and 220 crew hours. Seismograph crews usually operate ten hours a day, 22 days a month.

To handle these operations adequately, vast amounts of equipment are required. For land operations, these vehicles probably would be included in a typical field crew's equipment:

- One 1½-ton drill truck. Onto this truck are permanently mounted a miniature rotary drill, similar to a water well drill, and a hydraulic lift



Seismograph Operators At Work

Between the recording truck (foreground), where the answer to the seismologists efforts are traced, and explosives truck (left), is a seismograph party surveyor at work. He has just about pinpointed the exact site where the shot hole drill rig (background) will begin operations.

Seismograph shot hole drill truck at left is ready to begin drilling after being rigged up. Water truck at right will furnish water for drilling.

The shooter (right) feeds out a wire lead to his helper who makes ready to lower the charge into a recently-dug shot hole. The 300-pound stack of explosives is equivalent to an estimated two-day's seismic shooting activity in Gulf Coast region.

Top photo courtesy Tidelands Exploration Company. Middle photo courtesy McCollum Exploration Company.

derrick. In the more remote and rougher terrain, drilling units may be mounted on bulldozers which gouge out passable roads to drill sites for the remainder of the equipment. Some crews have had to resort to half-track or all-track vehicles.

- One 1½-ton water truck to furnish water for drilling. This number is increased to three or four, perhaps, if the water source is far distant from the scene of operations. Too, some areas require more water than average in drilling shot holes.

- One recording truck. This vehicle is usually a panel truck containing a dark room and developing and recording equipment.

- One 1½-ton shooting truck to carry powder, tamping equipment and small water tank.

- One party chief's car—usually a sedan.

- One personnel carrier. Some exploration companies choose a station wagon with a third seat. Others use pickup trucks, which can be equipped with removable seats and canvas covers for $150 per truck, thus allowing convertibility on short notice.

- One pickup truck for surveyors and their equipment.

- One reel truck.

Exploration companies usually build and mount bodies for various vehicles to their own specifications.

Helicopters, marsh buggies and boats, of course, have been drawn into the continuing search for favorable drilling sites in otherwise impassable terrain, marsh lands and open water.

Costs Run High. In addition to the cost of outfitting seismograph crews with equipment and initial supplies, maintaining a single crew for a crew month reaches high into the five-figure bracket. In open Gulf waters, the monthly price runs up to $60,000. In West Texas, the cost wavers between $30,000 and $40,000. Operations in swamp lands, such as south Louisiana, require approximately $20,000 monthly; less difficult terrain, as found in the interior, costs about $10,000 per crew month.

The speed of seismic operations depends upon many factors, major among which is terrain. The number of shots per crew day may range from about five in swamp lands and bogs to as many as 150 to 225, or even more, in open water. Sandwiched in between these extremes are the six shots per day which can normally be handled in not-too-rough mountain terrain and the ten shots a day usually averaged throughout the plains regions.

Drilling activity in the West Texas plains is slowed down because surface formations are extremely hard. And here, another factor enters the picture—availability of water. Operations in arid West Texas lead some crews to add a second or third water truck to the roster. Some exploration crews in West Texas have turned to air drilling in an effort to speed up operations. However, hard formations and water supply still are major factors.

While operations in the open Gulf are normally routine and fast, inland water activity moves slower. There, a dozen shots may be called average, each covering a quarter of a mile. Thus, inland water crews cover approximately three to three and a half miles a day.

Swamps of the Louisiana variety offer other problems. In some areas, crew members must carry all equipment on their backs—especially in regions where timber prevents use of a marsh buggy and its balloon tires. And there a seismograph crew may number 20 or 30. An average day's work in the swamps would result in from three to five shots.

Amounts of explosives used per drill hole vary greatly. In parts of Kansas, where shallow formation information is sought, a quarter of a pound of explosive is adequate. In Southwest Texas areas, 200 pounds per shot hole are often used.

Depth of Hole. How deep the drill hole must be again depends upon geography. West Texas shot holes oftentimes reach 300 feet; Upper Gulf Coast holes 30 to 50 feet.

When the shot hole had been prepared in Terrebonne Parish that last day in December, recording and shooting units moved into position. The shooter and his helper eased the charge into the hole with loading poles, with the wire lead trailing across the ground. The hole was filled with water to tamp in the shot and the blaster set off the charge. Blown into extinction were the last few feet of the 114 million yards of wire leads used that year.

Texas, with its six districts, accounts for more seismic activity than any other state. On an average shooting day, crews detonate approximately 11,000 shots, travel slightly more than 800 miles on the job and use about 110,000 pounds of explosives. Annually, Texas seismologists run up a total exceeding 3 million shots, travel more than a quarter million miles and use in excess of 32 million pounds of explosives.

Second in average number of shots per shooting day is Montana, which totaled 1500 in 1952 and accounted for almost 30,000 miles, 45 million pounds of explosives plus, and about 400,000 shots.

On the basis of number of shots, North Dakota ranks third. Its annual seismic exploration activities account for approximately 300,000 shots, 20,000 miles and 3 million pounds of explosives.

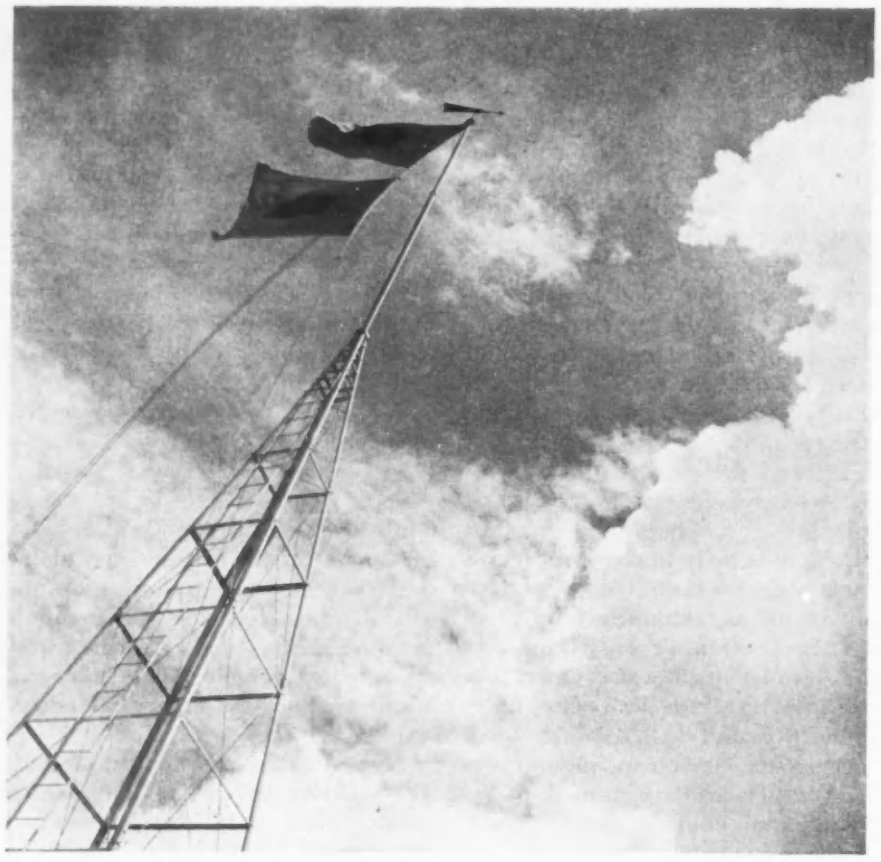
Following, in order of the number of shots each state averages per day, are Oklahoma, Wyoming, New Mexico, California, Mississippi, Louisiana and Colorado.

Louisiana, averaging about 474 shots daily, ranks second to Texas in the number of crews operating per work day—80. However, the state's southern region contains swamps, which materially reduce the number of shots capable of being set off within a normal work day. Texas has 188 crews operating per day.

How long will this pace continue? No answer appears definite. From 1928 to the present, Shawnee, Oklahoma, has been headquarters for from one to ten crews. And still new oil is being found.

This much is certain: seismic exploration will continue unabated until the economic limits are reached or until some better way is developed to do its particular job.

And neither is in sight yet.



Hurricane warnings, two red flags with ominous black centers, go up when . . . a storm prowls the Gulf of Mexico like a tiger. Where will it strike? Often it's impossible to tell with present facilities . . . so plants shut down and millions of dollars lost . . .

When the Big Winds Blow

By AL REESE and ROBERT E. SPANN, WORLD OIL Staff

TROPICAL STORMS that never hit the Gulf Coast have cost the oil industry more money than those that did.

Reason is the inadequate pinpointing of the whereabouts of these big winds which threaten oil and oil-allied installations silhouetting the Gulf shoreline more thickly than any place on earth.

In the order of importance, operators of oil installations exposed to tropical storms are concerned with the safety of personnel, the avoidance of damage to costly equipment, and the maintenance of economy and efficiency by the elimination of premature shutdowns and evacuations.

Long experience, advanced design, and a fuller knowledge of the sciences relating to hurricanes have won an improved, if still uneasy position in defense of life and property; but the industry has not yet been able to capitalize fully on war-perfected techniques, principally radar, which could prevent premature or unnecessary shutdowns.

Part 1

The tropical storm that puffs and bluffs around the Gulf until half a dozen major oil or oil-allied shore installations are shut down will cost millions of dollars.

This is lost production. It does not account for such factors as subpar output while the machinery is being brought into effective balance after operations are resumed, or the work deficiency of nervous employes during the storm threat.

On the drilling-producing side, the tropical storm that forces the shutdown of a rig will cost an operator about $2000 a day. Figuring several days' shutdown for as many offshore rigs as were in operation in late 1950, and which will again be active when tidelands operations are fully resumed, the cost—needless cost—of a single storm that threatens but does not strike can approach $100,000.

Another considerable dollar loss is involved in emergency precautions for coastal pipe line facilities. Barges tie up outside the storm area and tankers hurry to a safe harbor or stand outside to ride out the blow. This means that crude soon fills terminal tankage, backs up into tank farms along the line, and forces the shutdown of pumping stations.

All disturbances do not require emergency precautions, but the frequency of expensive shutdowns and evacuations is suggested by the listing in Table 1 of hurricanes and tropical storms which affected the Gulf from 1944 through 1951. There were no major winds in the Gulf during 1952.

Table 2 gives the total loss of life and property damage suffered in U.S. storms from 1926 through 1950. The lessening loss of life is a true index of improved protection. The loss of property listing is distorted by inflated valuations.

Big Task. These unnecessary shutdowns and evacuations could be lessened through maximum use of available facilities to augment the efforts of the U. S. Weather Bureau Hurricane Warning Service. This prodi-

gious enterprise, for all its intricate mechanism of ships, planes, radio and radar, and for all the knowledge of climatology, oceanography and meteorology possessed by its personnel, cannot assure the all-weather efficiency of Gulf Coast installations. The tremendous areas which perforce are covered by the Hurricane Service's advisories make them too general for effective precautions at specific locations. This is true for a plant ashore which, in the main, must guard only against direct blows of winds in excess of 100 miles per hour, and it is emphatically true for an offshore rig. Here the danger is not confined to the direct action of winds. Vicious waves and ponderous tides running well ahead of the storm demand a quick, localized decision.

Records of the U. S. Weather Bureau describe the comparative havoc of winds vs. waves and tides. Of approximately 16,000 fatalities in 67 major storms since 1873, more than 80 percent have been caused by drowning as a result of heavy tides breaking upon low, exposed coasts, or by the displacement of large bodies of water.

But despite its limitations, the Weather Bureau Hurricane Service is indispensable to the Gulf Coast oil industry. Begun in 1873 and reorganized in 1935, the service has three functions: to collect reports, issue forecasts and warnings, and to distribute information to the public. Its principal facilities are a 43-station hurricane teletype circuit, Air Force and Navy planes and radar, ships at sea, and privately or institutionally-owned radar. Special reports are received from Coast Guard stations, lighthouses, stations in Mexico, Central and South America, the West Indies, and the Bahamas. In emergencies, when the usual channels of communication may be inoperable, it may rely on ham radio operators with their own emergency power sources, and mobile telephone company equipment.

The teletype circuit is strung from Brownsville, Texas, to New England, with the coordination point centered at Miami and the principal forecast hubs at San Juan, Miami, New Orleans, Washington and Boston. These centers have the responsibility of working with the Air Force and Navy to send aircraft to patrol areas of suspected hurricane activity.

FIGURE 1 Wide World Photo

The eye of the hurricane as it appears on a radarscope here resembles a huge number 6. The eye is a place of strange calm and clear skies, sometimes 10 to 20 miles in diameter, around which winds and rain whirl violently.

How It Works. In practice, the Hurricane Service works like this: It is a day of the June 15-to-October 31 hurricane season. South of Puerto Rico the Caribbean waters heave sluggishly under a white-hot sun. Columns of damp air spiral up, and at one point they merge into a humid shaft which thickens and lengthens as the hot air mounts and cooler air moves in from the sides to replace it. Now the top of the sultry column is 30,000 feet up, and suddenly it bumps into an umbrella of cold air. The column mushrooms, the hot, moist air condenses, and tons of water splash into the Gulf.

Now the gentle tug of the rotating earth begins to affect the column. It spins—always counter-clockwise in the Northern Hemisphere—and at the center, the point of lowest barometric pressure, the hurricane eye forms, not unlike the center hole in a thick, black phonograph record.

The big wind moves ahead, usually at 10 to 12 miles an hour, but sometimes as slow as 8 miles per hour or

TABLE 1

Hurricanes and Tropical Storms Affecting Gulf of Mexico, 1944-1951

	1944	1945	1946	1947	1948	1949	1950	1951	Total
Tropical Storms Originating in Gulf	2	1	2	3	1	2	1	1	13
Hurricanes Originating in Gulf	0	1	0	0	1	2	2	1	7
Tropical Storms Entering Gulf	0	1	0	2	0	0	0	0	3
Hurricanes Entering Gulf	3	1	1	3	2	1	2	1	14
Total	5	4	3	8	4	5	5	3	37

TABLE 2

U. S. Losses in Tropical Storms

PERIOD	Total Property Damage	Total Loss of Life
1926–30	$131,153,000	2108
1931–35	60,910,000	494
1936–40	257,333,050	663
1941–45	296,924,100	107
1946–50	253,700,000	69

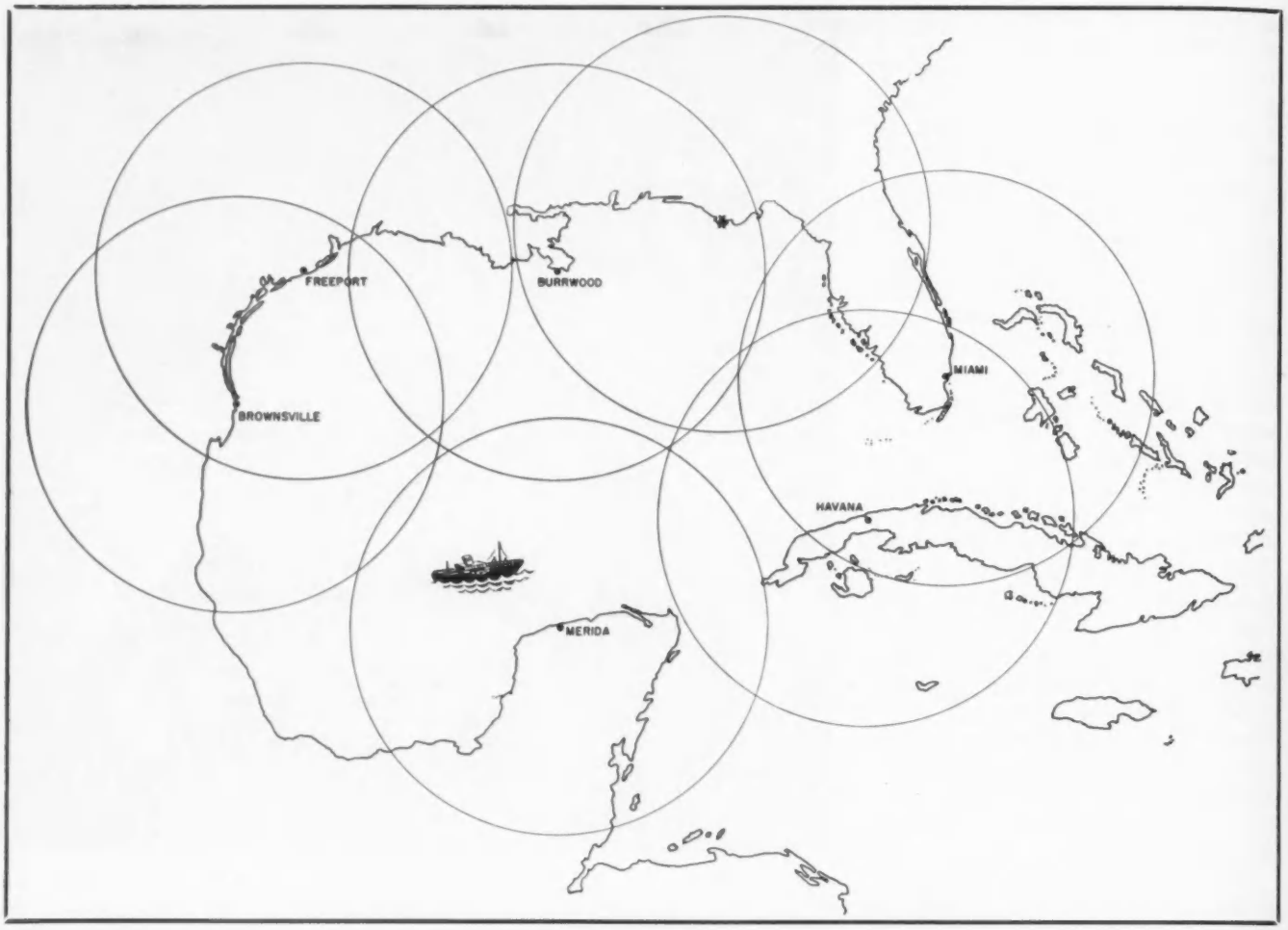


FIGURE 2

Roy C. Jorgensen, research engineer in The Dow Chemical Company Electrochemical Engineering department, suggests that a basic radar network such as the one represented here would improve safety and efficiency at all Gulf Coast installations by pinpointing a hurricane almost anywhere in the Gulf. An important missing link in the existing radar chain is at Merida on Mexico's Yucatan Peninsula. Another blind spot is between Burrwood and Miami. A weather ship in the Gulf is also needed.

as fast as 23 miles per hour. It has now passed from the tropical storm stage (25- to 74-mile winds) and is a full-fledged hurricane.

In direction, it is following one of the hurricane tracks which vary with the month of occurrence. During August, September and October, most of them start westward across the Atlantic, swinging more and more to the north and then northeast. (The great Galveston storm that took 6000 lives in September, 1900, was born near the Cape Verde Islands in the Atlantic, passed south of Santo Domingo, crossed the western tip of Cuba, and might have gone north along the Atlantic but for a wall of high barometric pressure which deflected it westward, almost parallel to the coast.)

The widespread atmospheric unrest caused by the big wind is noticed on the Weather Bureau's charts. A plane from a unit of the world-wide Air Weather Service goes out to investigate and remains to scout and probe the big wind. The hurricane report is confirmed, and around the teletype circuit goes the first official word on Hurricane Alice—so-named under the phonetic alphabet used in voice radio communication because it is the first hurricane of the year. (Feminine names are to be used for the first time this year to identify hurricanes.) When the plane returns to base, another replaces it. From now until the big wind blows itself to death it will be hounded by a weather plane—a buzzing gnat dogging a mad bull elephant.

Radar In Action. Now the hurricane charges at the coast, 300 miles away, and enters the vision of radar. This is the war-born weather sleuth which, in sufficient numbers and if strategically located, could so closely chart the movement, direction and speed of the big winds as to furnish the Weather Bureau with enough additional information to guarantee maximum efficiency and security for onshore installations and somewhat improve the precarious situation of offshore rigs. But there is not now sufficient radar, so many a plant begins the expensive shutting-in procedure and many a rig is evacuated.

Notable among the plants which might remain in full production during the storm threat are those of The Dow Chemical Company at Freeport, which has the largest radar set of those now in constant operation on the Gulf Coast periphery. Others are at Brownsville, operated by the Weather Bureau; Corpus Christi, furnished by Texas A. and I. College, maintained by the Central Power and Light Company, and with observation by the Weather Bureau; Victoria, furnished by Copano Research Foundation, with observation by the Weather Bureau; Burrwood, La., owned and operated by the Weather Bureau; Gainesville, Fla., operated by

FIGURE 3

The antenna for the Dow set, originally 36 feet above sea level (left), was raised to 107 feet and enclosed in a fiber glass and plastic dome (right) to protect it from high winds.

FIGURE 4

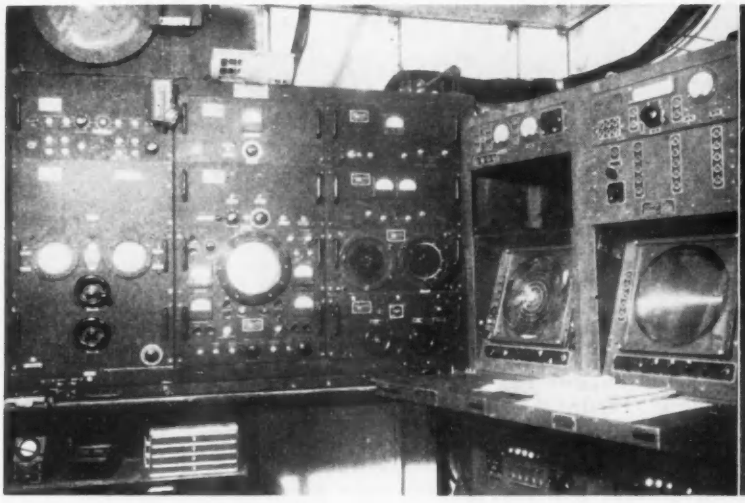


FIGURE 5

Control panel of Dow radar set (left). On extreme right of panel is Type 'A' scope, which gives distance and comparable intensities of rainstorms. Two PPI (plan position indicator) scopes at right center and upper left of panel give range and direction of rain areas with reference to radar location.

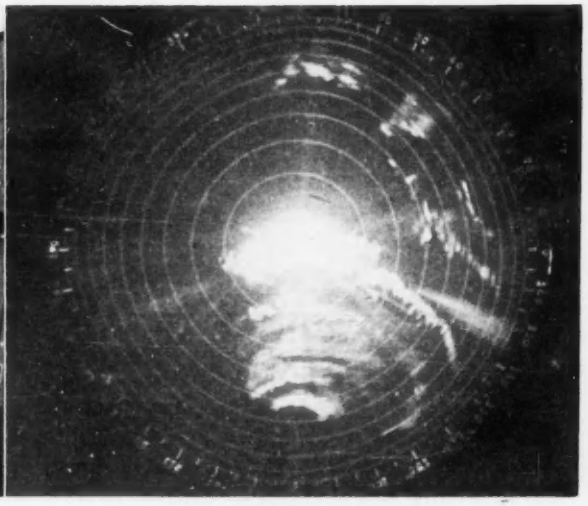


FIGURE 6

The irregular white arcs in the lower part of the photo at right represent radar reflections from bands of heavy rains. Sustained radar returns of this type have never been observed from any cause other than hurricane.

the University of Florida on government contract; Miami, owned by the Weather Bureau; and Tampa, owned by the Weather Bureau.

The Weather Bureau plans to put in operation at Miami before the approaching hurricane season an improved set with an operating range of approximately 200 miles. Similar sets will be installed before next fall at Brownsville and Burrwood. It is understood that a very large set having approximately 1 million watt power will be in operation during the coming hurricane season at the University of Miami. These additional installations are part of a Weather Bureau program to expand radar coverage of the Gulf Coast and inland areas, and are to be made despite a recent reduction in funds which constitutes a serious blow to the bureau's plans for a better hurricane network.

Case Histories. The value to each of these locations of a radar set, but the inadequacy of the chain as a whole to the storm defense of the entire Gulf Coast, can be illustrated by the case histories of two storms. During the summer of 1949 the Weather Bureau reported a tropical storm within 100 miles of the Texas coast. Without radar, the Dow plants would have been at least partially closed down. But the radar showed only rain squalls in a closed circulation (confirming the Weather Bureau report that this was a tropical storm) with no evidence of the spiral hurricane pattern like that in Figure 1. The plants continued full production, saving many thousands of dollars.

On October 2 of the same year a storm suddenly appeared just west of the Yucatan Peninsula. It was in a position to ravage the Mexican coast and was less than 500 miles south of Texas oil installations—yet it was completely out of range of all radar.

This blind spot, and others in the radar network, could be removed by addition of several stations and the strengthening of others. Figure 2 conveys the suggestion of Roy C. Jorgensen, research engineer in Dow's electrochemical engineering department, as to how the Gulf could be almost completely blanketed with radar.

To be effective, each unit in the radar chain would have to operate on the same principles of mutual assistance with the Weather Bureau as the Dow set. Radar was installed at

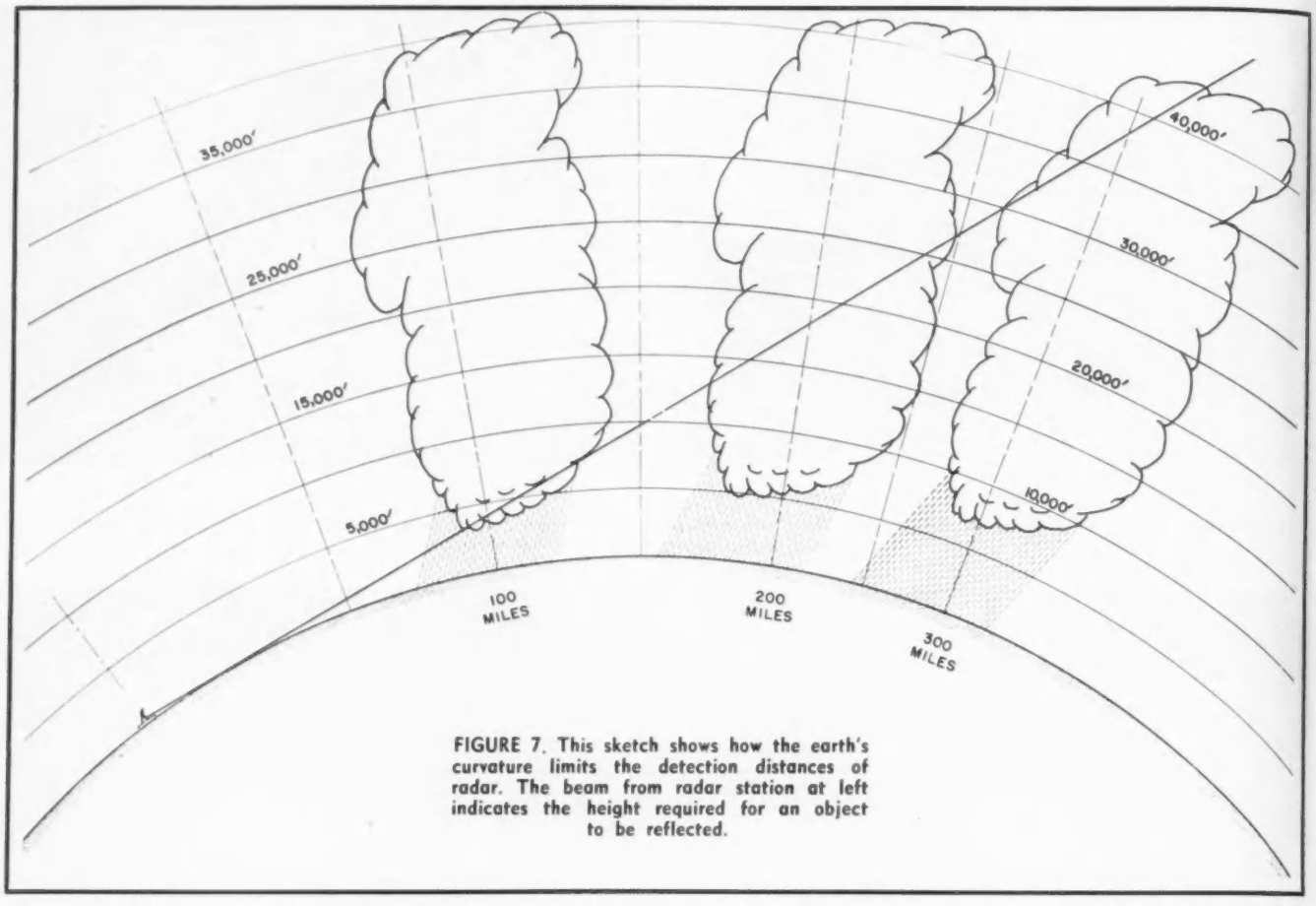


FIGURE 7. This sketch shows how the earth's curvature limits the detection distances of radar. The beam from radar station at left indicates the height required for an object to be reflected.

Dow after many other protective measures were considered during 1945-47 and discarded as being inadequate to the needs of the company's Freeport installations, which are unusually vulnerable. The microbarometric survey, an extension of the old technique of watching the barometer, was held to be insufficiently advanced. Microseismic observations, which consist of recording and analyzing earth vibrations caused by storm waves, were considered to hold little promise on the Gulf Coast because of the geological formation of the area. More favor was shown the ferrics method, which utilizes triangulation from simultaneous radio bearings of lightning static impulses from the storm. This system required several observation stations and good communications and coordination. Dow used the method for several years before abandoning it in favor of radar.

Upon the advice of the Weather Bureau, Dow purchased a trailer-mounted, war-surplus radar set and installed it under an agreement that all data obtained would be sent directly to the Weather Bureau and released to the public only through that agency. The set was installed about a half mile from the open Gulf on land about 36 feet above sea level (Figure 3). Later it was moved to another building (Figure 4) and its eight-foot diameter, spun aluminum parabolic reflector raised to 107 feet above sea level and enclosed in a fiber glass and plastic dome for protection from high winds.

Radar Principle. Basically, a radar set includes a transmitter, a parabolic reflector used in both sending and receiving, a special receiver, and an indicator (Figure 5). In principle, it is an echo device which transmits radio waves and records their return, much as a man who shouts at a cliff in certain locations and estimates its distance by measuring the time required for the echo to return. After the radar emits a pulse of radio waves, which travel at 186,300 miles per second, the electronic circuits translate the returning echo into a spot of light on the scope representative of the echoing object's distance and direction from the radar.

An object need not be opaque to radio waves in order to produce an echo. Just as a pane of glass may admit light and reflect light at the same time, so may an object produce a radio echo and still transmit a large percentage of the signal. This is the key to radar's usefulness in storm detection. Hurricanes are always accompanied by rain, and rain produces a radar echo. The irregular white arcs shown on Figure 6 represent radar reflections from bands of heavy rains. Sustained returns of this type have never been observed from any cause other than hurricanes.

Factors determining maximum distance of a radar beam are the size of the antenna, power output, receiver sensitivity, weather conditions and—most of all—the curvature of the earth (Figure 7). Thus, to be seen by the Dow set, an object 100 miles away must be at least 4000 feet up; an object 200 miles off must be 18,000 feet up; and 300 miles away, 38,000 feet. It is generally agreed that a hurricane may rise to 50,000 feet, but since the maximum height at which water drops or ice crystals are present is probably somewhat less, Jorgensen believes that no radar located on the ground will normally be able to detect a hurricane at ranges much in excess of 300 miles. Moreover, beyond the 300-mile range the radar beam would attain such heights as to overshoot any hurricane.

(First of Two Parts)

United Press Telephoto

President Dwight D. Eisenhower signs Tidelands bill in Washington, May 22. A group of congressmen watches as he applied his signature.

Eisenhower keeps a campaign promise. He signs tidelands bill and opens the door for . . .

Offshore Development To Be Speeded Up

By L. J. LOGAN, WORLD OIL Staff

OIL EXPLORATION and development on submerged lands off the U. S. coasts apparently will be accelerated soon, following action by Congress and the President restoring to the states the areas within their traditional boundaries and confirming existing state leases within that area.

Offshore operators have been encouraged by the progress made in settling the controversy between the federal and state governments over the ownership of the submerged lands. The delays in offshore operations caused by the controversy have been very costly to the operators.

Uncertainty remained regarding the areas of the continental shelf beyond the traditional state boundaries. However, operators believed that eventually legislation would confirm the state leases heretofore issued or would provide for issuance of federal leases to replace them. It was expected that legislation also would provide for issuance of future leases by the federal government.

President Eisenhower on May 22 signed the quitclaim bill passed by Congress. Passage of the legislation was consummated May 13, when the House of Representatives by 278 to 116 vote approved the Senate version of H. R. 4198. Under the bill, the federal government quitclaims to the coastal states the oil and gas rights to submerged lands within their historical boundaries. The Senate had approved the bill May 5 by a 56-to-35 vote, following continuous debate that began April 1, most of the opponents having been Democrats.

Title Confirmed. The bill that was enacted confirms title of the federal government to submerged lands beyond the historic state boundaries, which are three miles offshore, except in the cases of Texas and the Gulf (West) Coast of Florida, where they are three leagues or 10½ miles. However, the measure does not provide for development and administration of the federal areas.

To promote development on the federal as well as the state areas, the House of Representatives on the same date, May 13, approved and sent to the Senate another bill, H. R. 5134, by 309-to-91 vote. It would validate federal control of the outer portion of the Continental Shelf and permit the secretary of interior to issue oil and gas leases on those lands. This second bill passed by the House then went to the Senate for its consideration. Meanwhile, the Senate already had a committee working on its own plan for administering the Continental Shelf lands.

H. R. 4198, the bill that was sent to the President May 13 for his signature, was introduced in the House by Representative Lewis E. Graham (R-Penn.) It was approved by the House April 1 by 285-to-108 vote. As approved then, the bill contained provisions for federal leasing of the outer portions of the Continental Shelf. The Senate deleted those provisions May 5 and the House acquiesced May 13. But the House sought to save the eliminated portions dealing with leasing the federal areas by putting them into the second bill, H. R. 5134.

H. R. 5134 proposed to authorize the secretary of interior to issue fed-

eral leases on federal areas to replace leases heretofore obtained by operators from the state governments. The bill also would provide for future leasing by the federal government of federal offshore areas heretofore not leased to operators by the state governments.

Another Question. The new quitclaim law appears to settle the question of ownership of the Continental Shelf. However, another question has been raised, as to the constitutionality of the quitclaim measure. Some questioned whether Congress, under the constitution, has the power to quitclaim the title to the submerged lands involved.

Attorney General Brownell, in testimony at a Congressional committee hearing, gave the impression he would not relish the responsibility of upholding the constitutionality of a straight-out quitclaim law if it should be attacked in the courts. At that time he suggested that the issue might be avoided and the states might get what they wanted by enactment of a law not mentioning title but giving coastal states control of and revenue from natural resources within the historic state boundaries.

This method was not acceptable to many of the supporters of the state's claims. They said that such legislation would not fully validate the state claims; that it would not guarantee full and permanent right of the states to have and to hold and benefit from the submerged lands as they traditionally did before the "tidelands seizure" by the Truman administration. Lawsuits already are being contemplated to contest the constitutionality of the new quitclaim act.

Activity to Increase Gradually. Passage of the new tidelands law will not generate a sudden, spectacular boom in drilling and development. But it will cause immediate stimulation of geophysical surveying, reconditioning of idled marine drilling equipment and boats, new engineering studies of operating methods, and much work by attorneys and land men in connection with leasing. Currently, about a dozen seismograph crews are at work off the Louisiana coast and half a dozen off the Texas coast.

Continued offshore drilling will be accelerated slowly because of uncertainties and details left unsettled by the new law. It remains to be seen whether development will be further restrained by legal challenging of the constitutionality of the quitclaim act.

Another important question is that of the exact dividing line between state and federal lands, especially where the coastline is highly irregular, jutting out and curving in alternately. Eventually, definite lines must be drawn and agreed upon between state and federal governments, and that will take time. Meanwhile, operators will have to stay well within state limits to be sure they are operating on valid state leases.

Beyond the state limits, development will have to await enactment of a new law authorizing exploration and exploitation of the federal lands, and plans must be initiated for granting leases and otherwise administering the federal lands.

Some operators who have held up actual drilling are reconditioning boats and other essential marine equipment and have drilling platforms stacked at coastal points in readiness for use. Other platforms are now on order. Barge builders and operators anticipate strong demand for large barges for hauling equipment to deep water sites, especially after the beginning of next year.

Further offshore development will be concentrated particularly along the Louisiana coast, where the sea gets deeper very gradually, and where results have been remarkably successful. Half of coastal Louisiana's 200 plus offshore wells so far drilled have proved productive. They are producing 12,000 barrels of oil and 50 to 100 million cubic feet of gas daily. Over 20 different offshore fields have been discovered, including 11 that have oil production, the remainder having yielded gas and gas-distillate. On the Texas coast only one discovery, a gas-distillate producer, near Galveston, has been the reward for drilling 16 offshore wells.

The production so far developed is only a small percentage of that confidently expected in the future. The National Petroleum Council recently estimated that with operators free to proceed, production could be stepped up within five years to 200,000 barrels of oil and 600 to 800 million cubic feet of gas per day. Thereafter the output could be further increased sharply, said NPC, "because of additional development of discovered fields, improved techniques, and later discovery and development resulting from continued exploration." The report and a map of the Continental Shelf was presented in WORLD OIL of April, 1953, pages 64-65.

The Continental Shelf is the submerged belt along the coasts where the ocean floor gradually slopes from low tide mark to the true edge of the continent at water depth of about 600 feet, beyond which it plunges rapidly to depths of several thousands of feet. This shelf represents a continuation of the land beneath the waters of the sea. It is therefore similar to the terrain of the adjacent coasts. The shelf area is thus narrow and steep along the Pacific Coast, mostly less than 20 miles wide. But it is wide along the Gulf Coast, mostly 100 to 175 miles wide, sloping gently at the average rate of about 6 feet per mile or 60 feet in 10 miles.

On that basis, the Gulf Coast operator can go out an average of about 10 miles and still be within water depth of 60 feet, the maximum depth in which drilling has been considered feasible with present equipment and methods. Where the slope is gentle and the shelf wide, wells have been drilled farther out. The first discovery well from which land could not be seen was 17 miles off the Louisiana shore. The greatest distance from shore at which any well has been drilled so far was about 28 miles off the Louisiana coast.

Within the belt of 60-foot water on the Gulf Coast are 14,000 square miles of immediately prospective oil lands. But the total area out to 600-foot water depth is 132,000 square miles. Operators think the prospective producing area can be greatly expanded within a few years by developing equipment and methods making it possible to drill in water 100 to 150 feet deep. Potential Gulf Coast offshore oil reserves are believed by some qualified men to be in excess of 10 billion barrels or equivalent to more than one third of present proved reserves of the U. S.

Nearly all major companies of the U. S. and some independents have state leases on Gulf Coast submerged lands, and most of them already have participated in exploratory and development work, jointly if not individually.

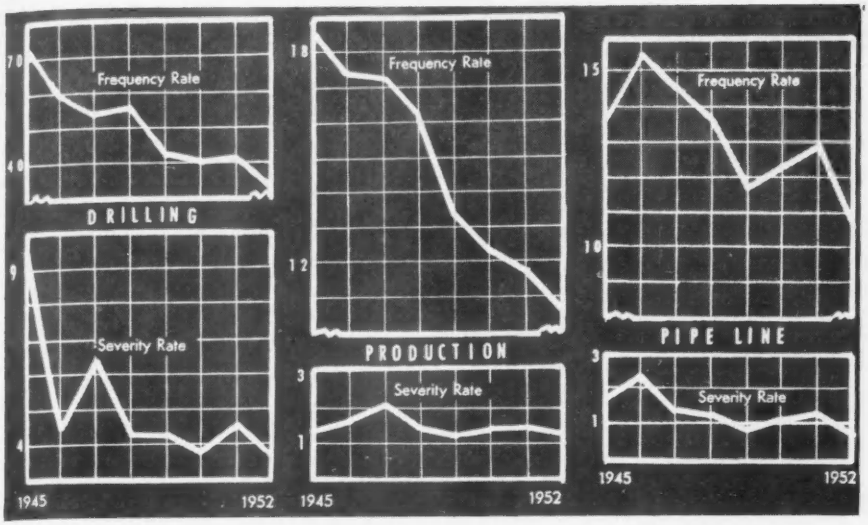


FIGURE 1 FIGURE 2 FIGURE 3

In drilling . . . production . . . pipe line . . .

Industry Safety Record Is the Best in History

INTENSIFIED EFFORTS of petroleum safety engineers in the postwar years to make the industry a safer place to work are paying dividends. While there is still room for improvement in the accident record, the annual survey of accident statistics compiled by The American Petroleum Institute showed the industry's safety record last year was the best in its history.

The new low reached in frequency rates of disabling injuries was a reversal of the 1951 upturn which marred the steady annual improvement of previous postwar years. The frequency rate of total injuries—temporary, permanent and fatal—for the industry as a whole declined to 9.67 per million man-hours worked in 1952. This was the first time this index figure dropped below ten and is of more significance when it is realized that industry operations and employment levels reached new peaks during the year.

Over-all improvement in the safety record has been significant in the postwar years, with the frequency rate of accidents declining from the near peak of 14.43 for each million man-hours worked in 1945. The sharp decline came in a period when the industry was faced with accelerated expansion of all facilities to meet growing needs, the period when total demand increased from 5,358,000 barrels daily to 7,726,000 barrels per day, annual well completions rose from 27,140 to 46,412, and new pipe line construction jumped from 3211 miles in 1945 to 13,910 last year.

Improvement in the safety record in the face of such expansion is concrete evidence that investments in safety programs and safe practices are valuable. While the severity rate of 1952 total injuries—the number of shift days lost per injury—dropped to 1.04 per thousand man-hours worked from 1.29 in 1951, the severity rate last year was higher than the record low established in 1950 of 0.84. The ratio of days lost to injuries in 1952, including fatalities, averaged 107 days per injury, compared with 123 days in 1951. Excluding fatalities, the 1952 average of days lost per injury was 40, compared with 39 in 1951.

The accident survey for 1952 was based on the collective experience of nearly 300 oil companies employing 516,180 persons and involving total exposure of more than 1 billion man hours. Of the 10,549 injuries recorded, 10,079 were classified as temporary, 350 were listed as permanent-partial and 120 were deaths or permanent-total disabilities.

Improvement in accident prevention in all branches of the industry was responsible for the over-all safety record reached, with particular emphasis on the sharp reduction in accident frequency rate in drilling operations, the most hazardous of all industry divisions.

The frequency rate of drilling injuries reached a new low of 34.72 per million man-hours worked in 1952, or less than half the frequency rate of injuries of 74.73 sustained in 1945. The severity rate of drilling injuries declined from 9.51 days lost per thousand man-hours worked in 1945 to 3.84 last year (Figure 1).

While the number of wells drilled in 1952 was slightly under the peak set in 1951, footage drilled last year set a new record of 186.4 million feet. To achieve this total depth record a greater number of rigs and drilling crews were required, both of which are factors that could have resulted in a higher accident frequency rate. Improvements in equipment have played an important part in the reduction of drilling accidents, but the work of safety engineers and the adoption of safety practices has been the most significant factor responsible.

Improvement in accident frequency continued during 1952 in the production branch, which has had an increasingly better safety record in each postwar year. Production's 1952 frequency rate as shown in Figure 2 declined to 10.64 per million man-hours worked from 11.70 in 1951. The severity rate declined to 1.34 per thousand man-hours worked, though it was above the low reached in 1949 of 1.20.

The safety record of the pipe line branch showed considerable improvement over 1951 in spite of an increase in new construction last year. The accident frequency and severity rates as shown in Figure 3 were the best of the postwar period for pipe line operations. The frequency rate was lowered to 10.60 per million man-hours worked and the severity rate of injuries was reduced to 0.84 per thousand man-hours worked. The improved accident rate in pipe line operations in 1952 followed a sharp upturn in injury frequency of 1950 and 1951.

The Changing Panorama

The Spirit of '76 at Work Again

A strong tide of public sentiment is running for decentralizing U. S. government. It is evidenced in newspaper editorials, speeches by widely known men, and in the conversation of the people. Americans have at last grown suspicious of centralized government and antagonistic to its encroachment on powers of state and local governments and on the rights of individuals. Last fall Americans decided it was time for a change, and a major change that they want is less interference by the national government in local and personal affairs. Just as Americans demanded freedom from a foreign power in 1776, they are demanding a minimum of rule from their own national government in 1953. With the national election of last November there was a new Declaration of Independence.

Plans for returning certain federal functions and powers to the states have been buoyed by a strong wave of popular support.

The states were banded together in a republic whose central government was never intended to assume powers beyond certain well-defined limitations. Public apathy during the past 20 years permitted the national administration to bypass those limitations. But that attitude has now been shaken off, and the policies of the new administration are reflecting the new thinking.

There'll Be Some Changes at FTC

A shift of policies of the Federal Trade Commission toward the conservative is in prospect. Edward F. Howrey, Republican, has been appointed to the commission and made chairman by President Eisenhower, succeeding James M. Mead, Democrat, who will remain on the commission. Lowell B. Mason, Republican, already was a member of the commission. In September, a third Republican is expected to be appointed to the agency, when the term of Stephen J. Spingarn, Democrat, expires. That would give the Republicans a majority on the five-man board.

Change of policies appeared possible immediately, for on the commission with the two Republicans will be Albert A. Carretta, a "conservative" Democrat.

Formerly, the commission was under the control of "liberal" Democrats, and policies were determined by men of those views.

FTC policies have affected the petroleum industry in connection with the lately publicized world oil cartel case, as well as in the marketing of petroleum products in general.

Kuykendall OK by the Oil Industry

Satisfactory to the oil and gas industries was the appointment of Jerome K. Kuykendall, of Olympia, Wash., member of the Washington State Utilities Commission, as a member of the Federal Power Commission to replace Thomas C. Buchanan. Kuykendall was sworn in May 15 as a member of the commission, and he was immediately named chairman of the FPC by President Eisenhower. Buchanan previously was chairman.

Kuykendall's statements before the Senate Commerce Committee, considering his appointment, apparently had satisfied Senator Schoeppel, Republican, Kansas, who has strongly advocated exemption of gas sales by independent operators from FPC regulations.

Kuykendall told the senators he opposed attempts of government agencies to stretch or distort the intent of Congress. He said he favored giving consideration to replacement costs in setting utility rates.

Learning Gets A Big Lift

Encouragement of privately financed liberal arts colleges and good public relations are combined by an oil company (Standard of Indiana) in giving $150,000 for use during 1953 in aiding such colleges in the 14 Midwest states where it markets directly.

The funds will be allocated among state associations of private colleges, which distribute corporate gifts equitably among their member colleges.

These colleges lately have had difficulty in maintaining high standards and reasonable faculty salaries while costs were rising and endowment income was shrinking. They have had to raise tuitions over 60 percent in the past 10 years and consequently are losing good prospective students to low-tuition tax-supported state institutions. This is unfortunate, as the independent colleges have contributed greatly to the intellectual, religious, and scientific leadership of the nation.

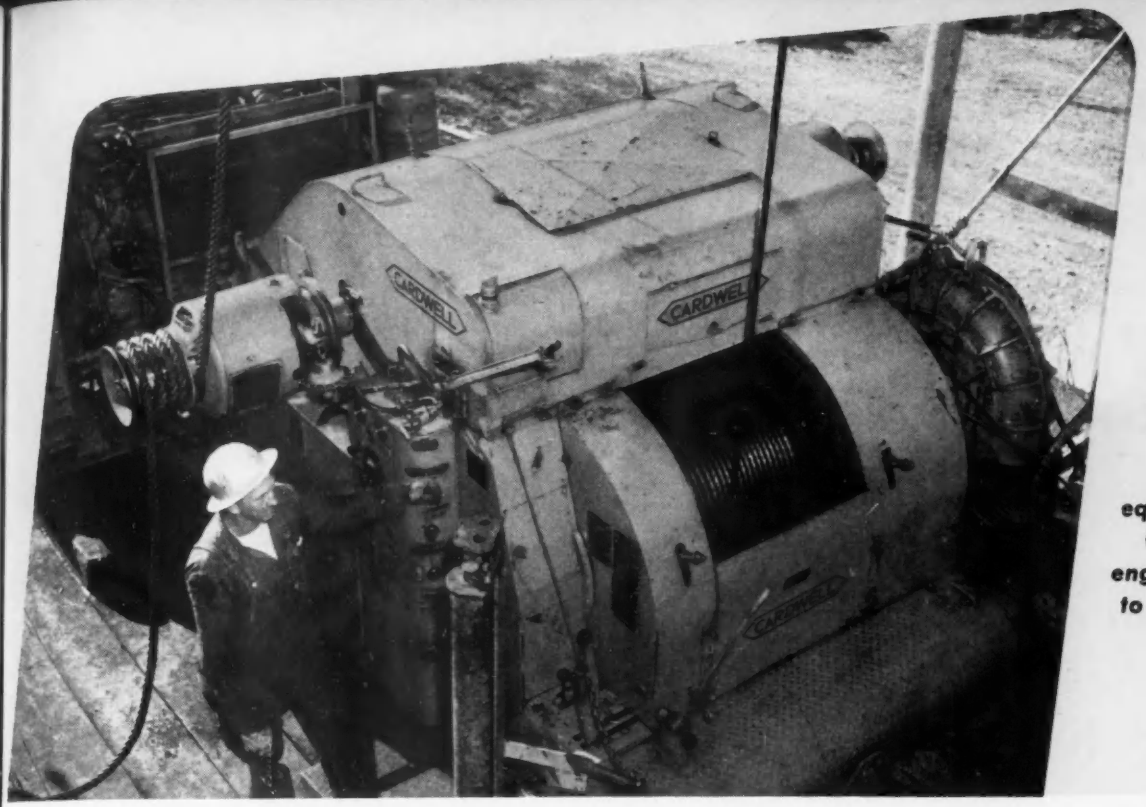
The above mentioned oil company stated that this grant did not affect the continuance of the 23 fellowships in graduate schools for which the company has in the past supplied funds, or the 14 undergraduate scholarships initiated last year in Midwest colleges which have done outstanding work in chemistry.

Record Pipe Line Program Foreseen

Almost 10,000 miles of oil pipe lines will be completed in 1953, an all time record, estimated J. Ed Warren, Deputy Petroleum Administrator for Defense May 14. Included will be 4500 miles of principal crude oil lines, 4500 miles of products lines, and 1000 miles of crude oil gathering lines. Cost of these lines will be about $460 million.

In 1952, the total was 6800 miles, including 5500 miles of principal crude oil and products lines and 1300 miles of gathering lines.

The work in 1953 will bring the total U. S. oil pipe line system up to about 173,000 miles.

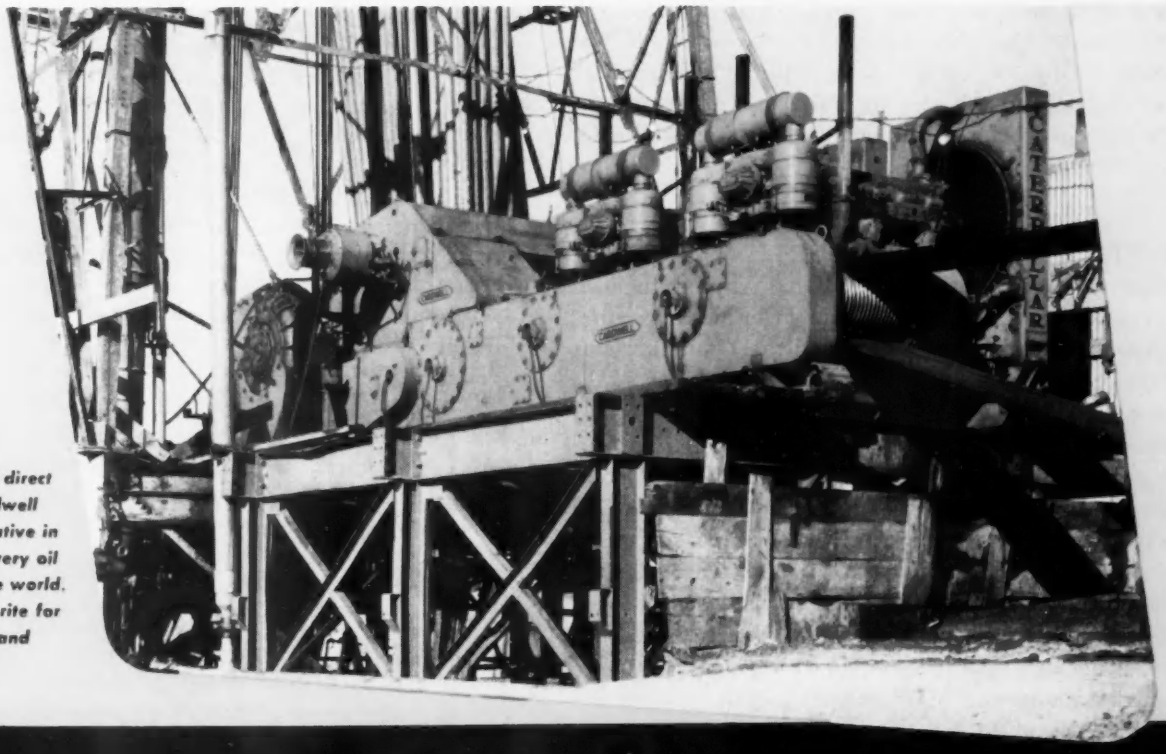


This Model O, equipped with two Caterpillar D375 engines, has drilled to 10,805 feet with 4½" drill pipe.

Thirteen years of continuous field use have proved that Cardwell has the fastest, most dependable, and easiest operated 6,000- to 10,000-foot draw works available. The Cardwell Model O air-controlled draw works combines rugged durability with utmost simplicity. It is equipped with Cardwell "Air-Disc" drum clutches, the only friction clutches that can be mounted in the drilling and sand line drums without increasing the rig width or reducing drum length, and still provide full capacity without slipping.

Other Model O clutch drives are equipped with Cardwell "Flex-Disc" air friction clutches that have been perfected through years of research.

Cardwell rigs are the only ones in the world with every wearing part heat-treated to eliminate down time as much as possible.



There is a direct local Cardwell representative in or near every oil field in the world. Wire or write for his name and address.

CARDWELL
REG U. S. TRADE MARK PAT OFFICE
THIS TRADE MARK INSURES HIGHEST QUALITY AT LOWEST PRICE

CARDWELL MFG. CO. INC.

P. O. Drawer 2001 . . . Long Distance Telephones 128—129—130
Cable Address: "ALL STEEL," Wichita — "CARDSTEEL," New York
Wichita, Kansas, U. S. A.

THERE IS A CARDWELL PARTS STOCK NEAR OR IN EVERY OIL FIELD OF THE WORLD

Report from the Observatory

Reduced Crude Stocks Desirable

By **RAY L. DUDLEY,** Publisher, and **WARREN L. BAKER,** Editor

NO HOPE for higher crude oil prices is in sight, despite being sorely needed to offset operating costs. Recent producing and importing rates have been more than ample to satisfy demand requirements. Consequently, crude stocks have been boosted to somewhat heavy volumes.

Therefore, crude production needs to be held within bounds during the next couple of months, despite assurance that motor fuel demand will undergo its usual seasonal increase. Enlargement of Texas' permissible production by 67,000 barrels daily in June will partially offset higher demand, creating further need for caution to be exercised before additional increases in production are permitted.

• • •

DESPITE REDUCED PRODUCTION, crude stocks continued to rise during April. This marked the fifth consecutive month to show a gain in crude inventories. Additions to storage have amounted to 11⅓ million barrels since the first of December, an average of 75,000 barrels per day.

Greatest factor causing a crude inventory gain in April was consumption, always at a low level during this month as demand switches from heating oil to motor fuel. This situation, coupled with a high crude importation rate and reduced runs to refinery stills, more than offset the reduction in domestic oil production.

U. S. crude production during April was 169,000 barrels less per day than in March, but imports of crude remained stationary at 637,000 barrels daily, and refinery crude runs dropped 220,000 barrels per day. As a result, crude stocks advanced an average of 126,000 barrels daily in April in contrast with a growth of only 41,500 barrels per day during March.

Despite producing 164,000 barrels less per day during April than in March, and 337,500 barrels below last December's peak, stocks of Texas crude rose 51,500 barrels daily. Oklahoma stocks advanced nearly as rapidly, with production showing a 2000-barrel-per-day gain. Illinois-Indiana stocks rose 33,000 barrels per day, Kansas by 21,000 barrels daily, and others by smaller amounts.

• • •

STOCKS OF CRUDE on May 9 were 10 million barrels greater than at the beginning of the year. Texas' crude stocks gained but slightly during this five-month period, indicating this state's producing rates has been better regulated to market demand than that of several other states.

Since the first of the year inventories in several regions have gained rather sharply. Stocks of Rocky Mountain crude have risen by 2 million barrels. Oklahoma and foreign stocks have advanced by 1¾ million barrels each. Kansas and Mississippi crude stocks have recorded a million-barrel gain. Smaller additions to storage have occurred in other regions.

Texas and Illinois are the only states to have reduced their production during this time. Practically all other states showed some increase in April over December producing rates, although the U. S. as a whole produced 273,000 barrels less per day.

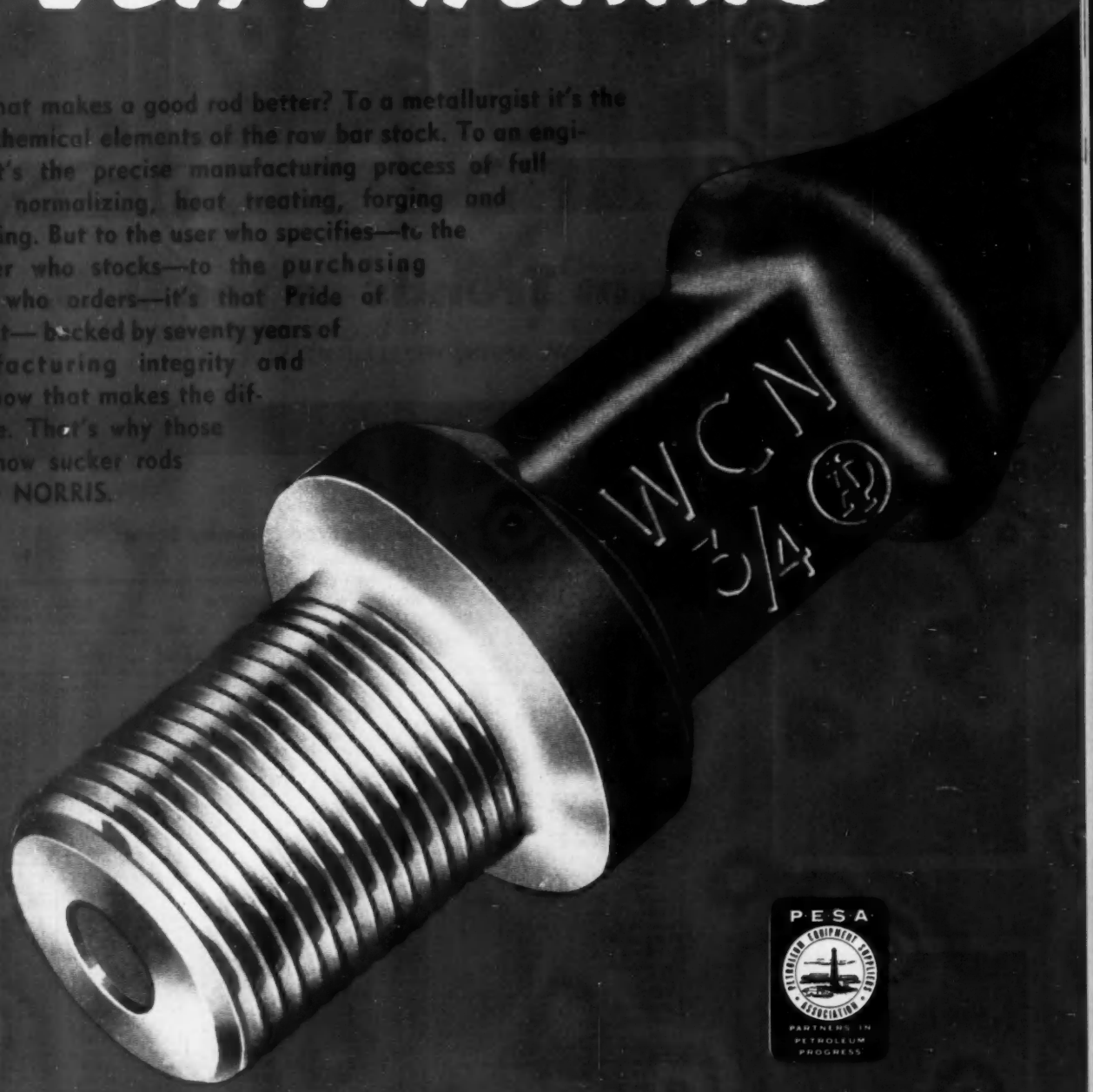
• • •

THERE IS A NEED for U. S. crude stocks to be reduced by 10 million barrels to a total of approximately 265 million. To achieve this reduction over a three month period, withdrawals from storage must average 100,000 barrels per day. This can be accomplished during the next three months, when higher demand will exist, without further reductions in producing rates. However, production must be held to its indicated June level.

Those Who Know Sucker Rods

SPECIFY NORRIS

Just what makes a good rod better? To a metallurgist it's the basic chemical elements of the raw bar stock. To an engineer it's the precise manufacturing process of full length normalizing, heat treating, forging and threading. But to the user who specifies—to the supplier who stocks—to the purchasing agent who orders—it's that Pride of Product—backed by seventy years of manufacturing integrity and know-how that makes the difference. That's why those who know sucker rods specify NORRIS.



PESA
PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION
PARTNERS IN PETROLEUM PROGRESS

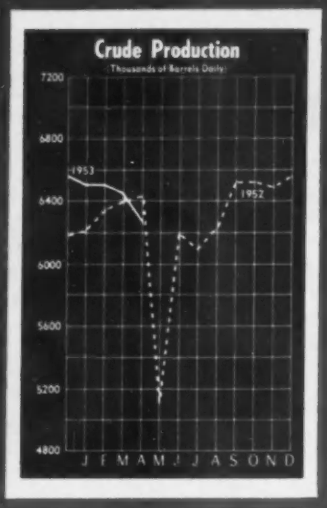
W.C. NORRIS, MANUFACTURER, INC.

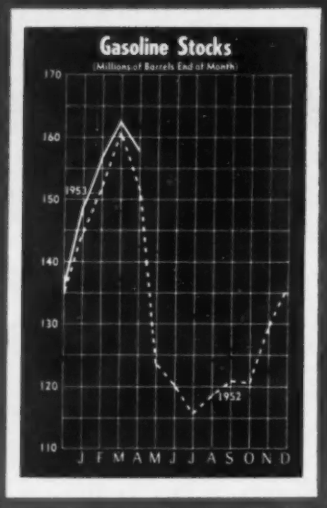
TULSA, OKLAHOMA

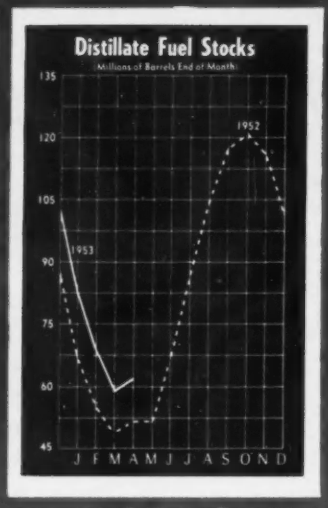
WEST COAST DISTRIBUTORS:
HICKEY PIPE & SUPPLY CO.
Los Angeles

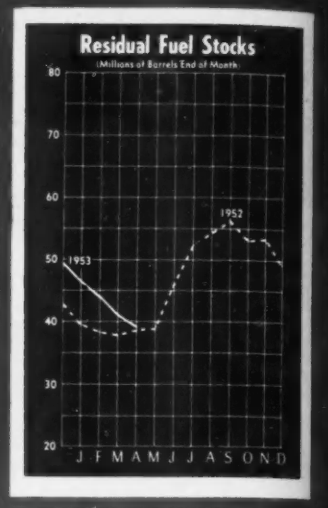
Since QUALITY NORRIS PRODUCTS 1882

BRANCHES:
HOUSTON, KILGORE, ODESSA, TEXAS
SALEM, ILLINOIS; CASPER, WYOMING
EXPORT: 30 ROCKEFELLER PLAZA, NEW YORK CITY



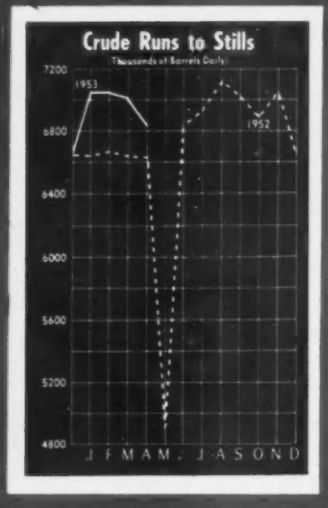


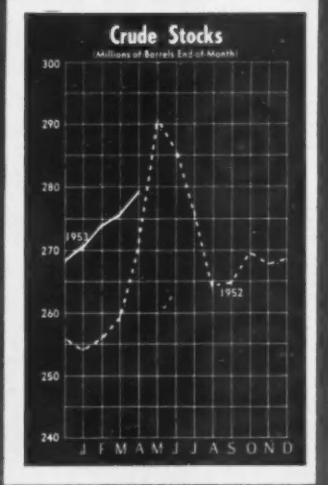




Petroleum Trends in the U. S.

By **CECIL W. SMITH,** WORLD OIL Staff

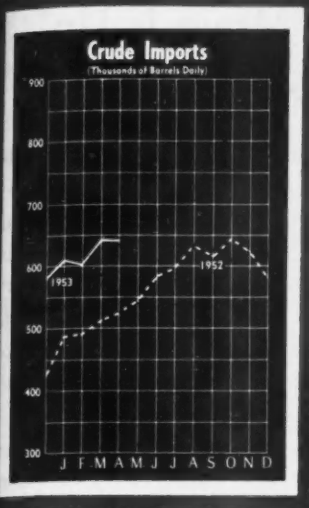


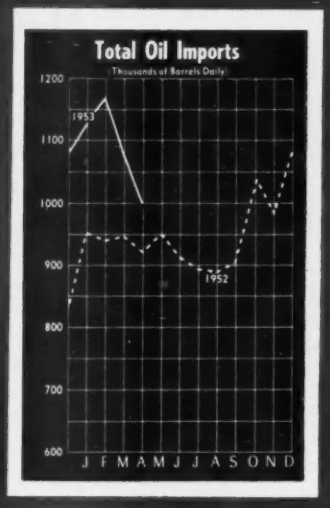


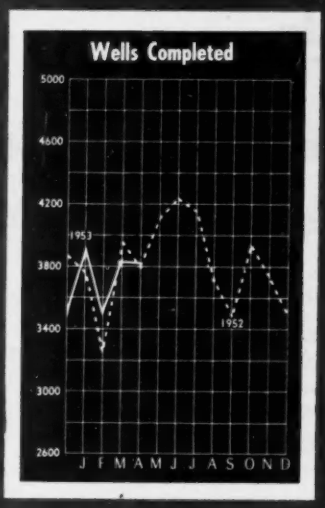
U. S. Crude Production by States

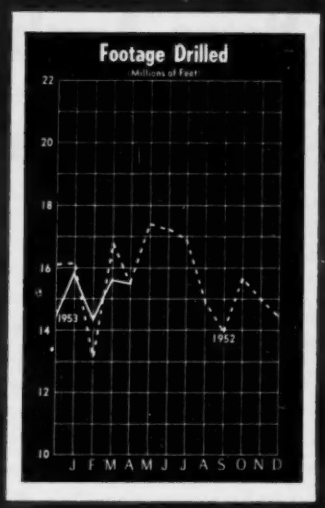
(Thousands of Barrels)

STATE or DISTRICT	DAILY AVERAGE PRODUCTION April, 1953	March, 1953	April, 1952	% Diff. April '52-'53	TOTAL PRODUCTION First Four Months 1953	1952	% Diff. '52-'53
Alabama	4.5	4.4	2.6	+ 73.1	502	315	+ 59.4
Arkansas	77.9	78.0	84.7	— 8.0	9,330	9,905	— 5.8
California	997.3	988.9	980.9	+ 1.7	118,954	118,138	+ 0.7
Colorado	93.5	89.9	82.9	+ 12.8	10,746	9,617	+ 11.7
Florida	1.5	1.5	1.7	— 11.8	181	206	— 12.1
Illinois	164.0	165.6	164.7	— 0.4	19,801	19,163	+ 3.3
Indiana	35.4	34.1	32.1	+ 10.3	4,113	3,713	+ 10.8
Kansas	326.6	337.2	334.0	— 2.2	39,813	39,705	+ 0.3
Kentucky	29.8	29.6	35.4	— 15.8	3,578	4,269	— 16.2
Louisiana	693.3	711.4	663.3	+ 4.5	83,957	78,940	+ 6.4
North Louisiana	115.2	116.2	121.5	— 5.2	13,806	14,485	— 4.7
South Louisiana	578.1	595.2	541.8	+ 6.7	70,151	64,455	+ 8.8
Michigan	34.1	33.8	35.4	— 3.7	4,147	4,440	— 6.6
Mississippi	97.1	97.0	99.9	— 2.8	11,600	12,057	— 3.8
Missouri	0.1	0.1	0.1	.....	4	9	— 55.6
Montana	31.6	31.1	24.2	+ 30.6	3,718	2,942	+ 26.4
Nebraska	12.9	12.6	5.8	+122.4	1,504	679	+121.5
New Mexico	182.9	178.7	167.7	+ 9.1	21,414	19,731	+ 8.5
New York	12.7	12.8	12.1	+ 5.0	1,547	1,416	+ 9.3
North Dakota	12.9	15.0	1.2	+975.0	1,718	65	.....
Ohio	9.2	9.4	8.9	+ 3.4	1,097	1,037	+ 5.8
Oklahoma	544.7	542.7	541.4	+ 0.6	64,575	64,939	— 0.6
Pennsylvania	28.3	28.5	32.5	— 12.9	3,394	3,731	— 9.0
Tennessee	.....	0.1	.....	.....	4	4	.....
Texas	2,669.1	2,833.1	2,920.0	— 8.6	340,863	349,252	— 2.4
Dist. 1: South Central	34.7	36.9	33.9	+ 2.4	4,375	4,025	+ 8.7
Dist. 2: Middle Gulf	151.9	157.6	165.5	— 8.2	19,305	20,115	— 4.0
Dist. 3: Upper Gulf	462.0	483.0	493.4	— 6.4	58,246	59,484	— 2.1
Dist. 4: Lower Gulf-S.W.	250.4	259.7	266.7	— 6.1	31,218	31,956	— 2.3
Dist. 5: East Central	47.0	48.9	61.4	— 23.5	6,031	7,218	— 16.5
Dist. 6: Northeast	378.0	375.7	397.0	— 4.8	46,151	47,951	— 3.8
Dist. 7-B: North Central	103.3	104.9	89.4	+ 15.5	12,951	10,600	+ 22.2
Dist. 7-C: West Central	140.4	178.8	139.6	+ 0.6	20,203	16,853	+ 19.9
Dist. 8: West	863.6	927.6	1,006.4	— 14.2	111,478	120,652	— 7.6
Dist. 9: North	165.6	187.3	161.5	+ 2.5	21,880	19,450	+ 12.5
Dist. 10: Panhandle	72.2	72.7	82.8	— 12.8	9,025	10,033	— 10.1
Utah	5.3	5.2	4.0	+ 32.5	626	506	+ 23.7
Virginia	0.1	0.1	0.1	.....	12	4	+200.0
West Virginia	7.6	7.0	7.4	+ 2.7	871	888	— 1.9
Wyoming	212.0	209.6	183.8	+ 15.3	25,024	22,526	+ 11.1
Total United States	6,284.4	6,453.4	6,426.8	— 2.2	773,093	768,197	+ 0.6









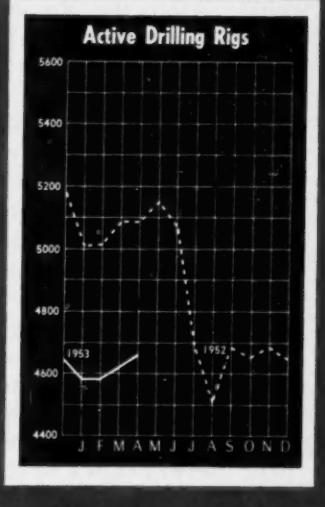
- **Oil imports lowered**
- **Crude production cut**
- **Runs to stills reduced**
- **Active rigs increased**

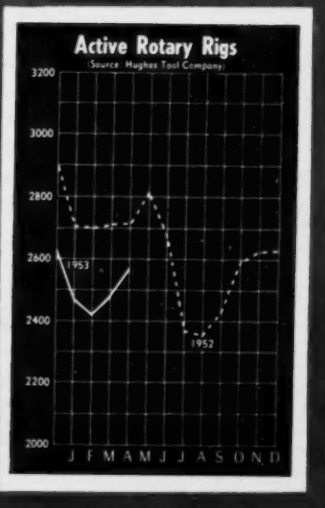
Crude Oil and Refined Products Trends

(Thousands of Barrels)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL		DAILY IMPORTS	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Crude Oil	Total Oils
1951:											
March	6,052	6,469	233,824	2,908	149,679	1,327	46,744	1,348	38,366	483	861
April	6,127	6,183	243,180	2,821	147,679	1,171	48,239	1,230	37,623	511	871
May	6,170	6,436	248,418	3,031	141,658	1,210	59,272	1,265	39,879	518	876
June	6,130	6,575	248,170	3,100	137,000	1,254	72,140	1,277	42,398	563	876
July	6,141	6,462	250,847	3,091	130,931	1,228	84,282	1,275	46,320	546	788
August	6,232	6,539	254,276	3,114	124,202	1,237	94,028	1,226	48,365	529	780
September	6,261	6,558	254,900	3,127	124,530	1,282	104,082	1,228	49,608	500	744
October	6,375	6,446	262,266	3,105	118,864	1,295	109,544	1,224	49,573	421	769
November	6,272	6,609	261,100	3,130	122,723	1,358	101,666	1,304	46,491	425	802
December	6,182	6,646	255,783	3,150	134,867	1,442	86,619	1,313	42,853	423	834
1952:											
January	6,217	6,640	254,007	3,094	144,339	1,456	66,969	1,338	39,523	488	951
February	6,367	6,673	255,900	3,109	151,912	1,528	55,369	1,322	38,295	491	940
March	6,388	6,640	259,126	3,069	160,689	1,400	48,750	1,274	37,971	510	947
April	6,429	6,435	270,679	2,995	151,890	1,312	51,634	1,253	38,561	539	922
May	5,107	4,905	290,813	2,295	123,656	982	51,648	979	38,821	545	951
June	6,197	6,825	285,964	3,169	120,166	1,455	65,911	1,228	45,688	581	911
July	6,093	6,927	275,951	3,295	116,566	1,475	85,775	1,237	52,245	597	892
August	6,219	7,118	264,368	3,377	118,592	1,514	104,257	1,252	54,061	632	879
September	6,518	7,017	264,723	3,428	120,991	1,502	117,252	1,230	56,200	615	932
October	6,518	6,883	269,776	3,301	120,062	1,458	120,721	1,203	53,052	643	1,037
November	6,487	7,049	267,852	3,416	129,509	1,510	116,096	1,299	53,069	624	984
December	6,634	6,952	271,928	3,361	136,028	1,509	99,582	1,302	48,706	603	1,165
1953:											
January	6,555	7,042	272,250	3,384	150,518	1,528	80,655	1,307	45,910	616	1,135
February	6,562	6,969	273,589	3,379	157,873	1,505	67,167	1,275	44,178	586	1,066
March	6,453	7,024	275,409	3,284	157,873	1,475	59,743	1,285	40,572	637	1,074
April	6,284	6,804	279,187	3,262	157,711	1,401	61,037	1,241	39,002	637	996
April, 1953 Change:											
In Month	—169	—220	+3,778	—22	—162	—74	+1,294	—44	—1,570	....	—78
In Year	—145	+369	+8,508	+267	+5,821	+89	+9,403	—12	+441	+98	+74
Week Ended:											
5-16-53	6,359	6,884	276,848	3,280	155,415	1,321	64,941	1,238	40,258	585	1,077
5-17-52	*	*	281,781	*	*	*	*	*	*	410	713

Source: Data for last two months from API; prior monthly data from Bureau of Mines. * Not available due to 1952 strike.





News Analysis

It Looks as if the Import Problem Will Be With Us for Another Year

Late in May it was indicated that Congress would leave the oil imports situation essentially unchanged for another year. Congress was expected to approve a one-year extension of the Reciprocal Trade Agreements Act. Present tariff rates on crude and products are based on that measure. Congress also was expected to authorize a foreign economic study commission, as requested by President Eisenhower. The commission would study and give advice on problems of international trade, and the advice could be taken into consideration by Congress a year from now upon considering again the reciprocal trade agreements.

During May there was voluminous debate before the House Ways and Means Committee, favoring and opposing the Simpson bill, H. R. 4294, introduced by Representative Simpson (R.-Penn.). The bill would extend the Reciprocal Trade Agreements Act for one year but with amendments in the nature of restrictions that are not contained in the present legislation. In addition, the bill would limit imports of crude oil and heavy fuel oil through the imposition of quotas, and would provide for higher duties on lead and zinc. The imports of crude oil and heavy residual fuel oil would be limited to fixed percentages of the previous year's demand in the U. S.

Witnesses favoring the Simpson bill included officers of the Independent Petroleum Association of America, independent oil producers, and representatives of the coal industry. They asserted that oil imports were seriously harming domestic oil producers and coal mining companies and workers.

Recommending that the reciprocal trade agreements act be extended without the amendments for setting up import quotas were executives of major oil importing companies. They said that imports had been necessary to avoid oil shortages in all but a few recent years and they would be necessary similarly in the future. Representatives of the U. S. State Department gave support to continuance of the trade agreements act but opposed new import restrictions, declaring quotas would damage international relations. Several associations of independent oil marketers aggressively fought the proposed new limitations on oil imports. They contended that imports of fuel oil and other oils were essential to meet U. S. needs; that barring of the imports would cause oil shortages and lead to excessive prices.

Next Move Is Up To Gas Companies

What next for the Texas gas gathering tax?

The Texas Supreme Court refused to accept the appeal by three gas companies from a Civil Appeals Court ruling that the tax is constitutional.

The companies contemplated seeking a motion for a rehearing from the Texas Supreme Court.

They could take the case to the U. S. Supreme Court, as they claim that the tax puts a burden on interstate commerce.

Revenue of about $40 million from this tax has been tied up by the litigation.

New Pipe Line to Solve Gas Waste Problem in the Spraberry Field

Gas waste in the Spraberry field of West Texas will be eliminated before the end of this year without any necessity of well closings by state authorities, as a new pipe line will then afford a market for gas heretofore wasted. The line started May 1 by Permian Basin Pipe Line Company will move gas to Northern Natural Gas Company's line in the Texas Panhandle, an interstate carrier, leading to Minneapolis. The new line will be controlled by Northern Natural. Casinghead gas will be processed by Phillips Petroleum Company plants, and Phillips will deliver 200 million cubic feet of residue gas per day to the pipe line. The gas will be purchased under contracts calling for a price of 10 cents per thousand cubic feet initially, and higher prices later through escalator clauses.

On April 1 the Texas Railroad Commission ordered about 2000 Spraberry field wells, producing about 82,000 barrels of oil per day, closed in because of wasting casinghead gas by flaring. The commission said production could not be resumed until facilities were put in operation to process and market the gas.

Law suits involving validity of the commission's shutdown orders were due to be heard by the Texas Supreme Court on May 28. Thirty-five producing concerns are involved in the litigation. They are not flaring gas and therefore obtained the right to continue producing oil under a district court permanent injunction. The court said only operators wasting gas could be closed down.

The Railroad Commission appealed to the Supreme Court, claiming the right to close wells throughout the field to prevent gas waste, pending installation of facilities to save the gas. The commission contends that it must close down non-flaring wells along with flaring wells, to prevent wells on production from draining oil and gas from adjacent closed-in leases.

Non-flaring companies declare the field-wide shutdown punishes both innocent and guilty. They say the commission is relinquishing its regulatory powers to non-conforming operators, whose failure to install gas saving equipment could idle the whole large field indefinitely.

District Judge Charles O. Betts of Austin conceded that the commission undoubtedly has the power to prevent waste of oil and gas but said that the effect on individual operators must be considered and their property rights must be protected.

"Y'know...the man's right!"

"Joe, the Lane-Wells man, I mean. Sometime back, he was urging me to try Lane-Wells packers. So I said, 'Why should I?' 'Because they'll give you better service,' he says. 'Why?' I said. 'Give me a reason.' 'Easy!' he comes back. 'Because oil-country men design 'em and build 'em to do the job the way you fellows want it. They run in easily, they set right where you want 'em, they give you leak-proof packoff just as long as you need it, they release without a struggle, and come out ready for more.'

"Well, he went on, giving me construction details and a raft of information. The upshot was, I tried some. Then I got some more. The man's right!"

LANE-WELLS PACKERS give me better service!

Tomorrow's Tools - Today!

604

General Offices, Export Office, Plant • 5610 So. Soto St., Los Angeles 58

LANE-WELLS COMPANY

LOS ANGELES • HOUSTON • OKLAHOMA CITY • LANE-WELLS CANADIAN CO. IN CANADA • PETRO-TECH SERVICE CO. IN VENEZUELA

Rocky Mountain Finds Customer

The U. S. Rocky Mountain oil industry is not sitting idly by and leaving the U. S. Pacific Northwest markets to either California or to Western Canada with its Edmonton-Vancouver pipe line, now under construction, which will supply Canadian and U. S. refineries in the Puget Sound area.

Oils from Utah, Wyoming and Colorado will soon go by pipe line as far northwest as the Spokane valley of the state of Washington.

Salt Lake Pipe Line Company, subsidiary of Standard Oil Company of California, between late June and the end of September this year will build a 135-mile products pipe line to Spokane from Pasco, Wash. This will be an extension to the existing products line to Pasco from Salt Lake City. With one pumping station, located at Pasco, the new line will have capacity for moving 15,000 barrels per day, handling gasolines and heating oils.

These products will be supplied by the Salt Lake City refinery of Salt Lake Refining Company, another subsidiary of Standard Oil Company of California. It has crude oil capacity of 27,000 barrels daily and cracked gasoline capacity of 4100 barrels daily. The plant is supplied with crude from Uinta Basin, Utah, fields and the Rangely field of Colorado by Salt Lake Pipe Line company's crude line.

Allowable Reflects Demand Increase

Some improvement in demand for domestic crude was evidenced in statements of representatives of crude oil purchasers at the latest monthly proration hearing of the Texas Railroad Commission. In accordance with majority opinion, the commission set allowable Texas crude production at 3,019,434 barrels daily, an increase of 66,832 from the May 9 allowable.

Most fields will be allowed to produce 20 days during June and the East Texas field 18 days. These producing days for the 30 days of June are the same as those for the 31 days of May, making the daily average allowable for June higher.

The Big Moment . . .

for E. DeGOLYER

Success in the oil industry comes through hard work, daring, and ingenuity. Sometimes it arrives slowly, sometimes quickly. But however it comes, it is preceded somewhere in the past by a moment of decision when the future is uncertain. Perhaps the fateful moment passes quietly, an almost unnoticed detail in the day's work; or perhaps it is a moment of high suspense. It is The Big Moment. This is one of a series describing the big moments of men in our industry.

E. DeGolyer might never have located a drop of oil if he hadn't first known where to find a cold bottle of beer.

The Big Moment in the career of the eminent geologist came on a sizzling Sunday afternoon in 1908 near Meeteetse, Wyo., where he was a field geologist with the U. S. Geological Survey.

E. DeGolyer

Life was austere. If any in the party except DeGolyer ever smoked or took a drink, he didn't know about it; and there was even a spartan rule that everyone had to don a coat before joining the buzzing flies at the table under the tarp stretched from the cook tent to the chuck wagon.

Perhaps these restraints were particularly irksome to young DeGolyer on this day because he had just finished working out the complicated geology of a township, and was in the mood to celebrate.

Then arrived Dr. C. Willard Hayes, chief geologist of the U. S. Geological Survey, to wonder aloud if anybody knew where he could find a cold bottle of beer.

From any other visitor such a question delivered in this chaste clime, in this puritanical camp, and on a Sunday, too, would have seemed as idly hopeless as that ancient conversational prop, "Think it'll ever rain?" and therefore not deserving of an answer.

But this was the chief of the whole Geological Survey, and DeGolyer thought he rated a reply.

"Yes, sir," said he, and forthwith led his chief to a cold bottle—the kingsize kind of the Old West.

Hayes was properly impressed, and the young man rose even higher in his esteem when he heard of the good job DeGolyer had done on the township's geology.

The next year he sent for DeGolyer. "How would you like to go to Mexico?"

That was how DeGolyer became a geologist for Mexican Eagle Oil Company, beginning a fabulous oil-finding career. Though a native Oklahoman, he was intent on being a mining engineer, had never given serious thought to the oil business. This was partly because a professor during his student days at the University of Oklahoma had warned there was no future in oil. Spindletop and Cushing had been discovered, and there were probably no more major deposits to be found, said teacher.

YES *and in all of these states*

for Oil and Gas Loans

In Louisiana, as in other great oil producing states, The National Bank of Commerce is ready, willing, and able to be of service to oil operators. The same prompt, confidential, specialized oil and gas loan service that you would get if you were right in Houston. You deal with oil men who are thoroughly familiar with the oil business . . . men who speak your language.

Like the scores of successful oil operators who have come to The National Bank of Commerce for counsel and financial assistance, you, too, are invited to discuss your problems with us.

E. O. BUCK, VICE PRESIDENT, OIL LOAN DEPARTMENT

THE NATIONAL BANK OF COMMERCE

OF HOUSTON

Gulf Building, Houston, Texas "The Bank for All the People"

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

COLORADO • WYOMING • NEBRASKA • NEW MEXICO • TEXAS • LOUISIANA • MISSISSIPPI

Iran Supplies Some Answers

- **How much oil is the country producing?**
- **How many wells are contemplated?**
- **What about the Abadan refinery?**

REGARDLESS OF IRAN'S successful attempts to sell a small volume of crude and refined products in the world market, operations of the giant Iranian petroleum industry continue at a near standstill. In the more than two years since the oil properties of Anglo-Iranian Oil Company, Ltd. were expropriated, the Abadan refinery has been operated by National Iranian Oil Company at no more than a token volume and inventories of finished products were at the near capacity level when Anglo-Iranian personnel made their forced exodus.

During 1952 the 500,000-barrel daily Abadan plant was operated at an average of 3.7 percent of capacity with a crude throughput of 21,280 barrels daily. Because of destruction at the plant by pilferers, affirmed by responsible non-Iranians, serious doubts exist that the plant could ever be placed on anywhere near full-scale operations again unless completely overhauled.

Meanwhile, National Iranian Oil has continued capacity operations at the small 2280-barrel-daily Kermanshah skimming refinery to supplement the meager output of Abadan to meet local demand, though such operations are not necessary due to the huge volume of products left in storage by Anglo-Iranian.

Exploration Stops. No exploratory effort has been made and only one well has been drilled—this a completion as a dry hole in 1951 of a well in the Lali field that was nearing completion when Anglo-Iranian was forced out. No wells were planned or drilled in 1952 and none has been planned for 1953.

These facts can be reported by WORLD OIL as the result of a questionnaire submitted to National Iranian Oil and answered by Dr. M. Q. Bayat, managing director of the government company that has been placed in charge of the oil properties. Dr. Bayat's identity is unknown to personnel of Anglo-Iranian Oil who spent years in Iran. He was named managing director of National Iranian at the end of 1952 at the time of mass resignations of Iranian officials who were members of the Supreme Council (board of directors) of the company in protest over administrative decisions and the appointment of Dr. Reza Falah as director of the Abadan refinery.

The report of Dr. Bayat to WORLD OIL showed Iranian crude oil production in 1952 at 17,292,842 barrels, or a daily average of 47,378 barrels, more than half of which was "recycled to reservoir" as "surplus" oil. Production in 1952 came from 18 wells (out of 87 termed "available for production"), of which 12 were in the Masjid-i-Sulaiman field and one each in the Naft Safid, Lali, Haft Kel, Agha Jari, Naft-I-Shah, and Gach Saran fields.

Net crude production in 1952, after deducting the volume "recycled," of 7,776,867 barrels was somewhat less than the NIOC reported crude runs to refineries totaling 8,499,080 barrels. It was not explained where the difference was made up, though presumably some crude may have been available in storage at the single crude tank farm of 1,626,400 barrels capacity at Bandar Mashur on the Khor Musa at the head of the Persian Gulf.

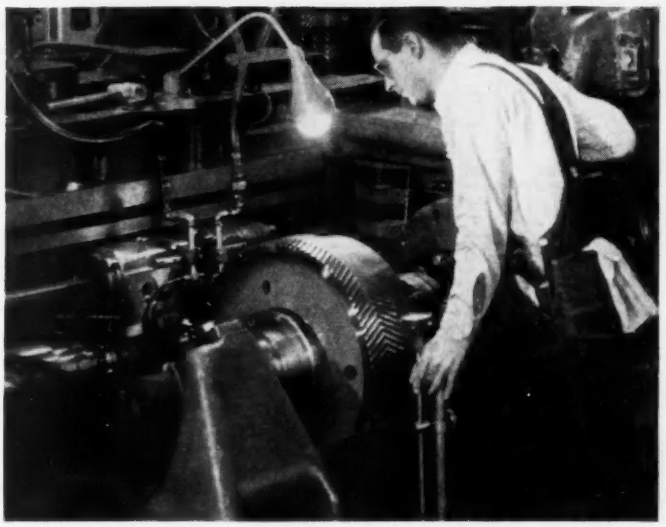
Big Mystery. The biggest mystery of Iranian oil operations, however, is what has happened to the indicated volume of refined products withdrawn from storage. At the end of 1951, NIOC reported to WORLD OIL, the volume of refined products in storage at Abadan and Kermanshah totaled 13,579,776 barrels, which was about in line with the finished product stocks left at the exit of Anglo-Iranian earlier in the year. NIOC reported total product inventories at the end of 1952 (which may well be a more recent figure) as 12,656,274 barrels, or a net withdrawal in 1952 (and possibly 1953) of 923,502 barrels.

Assuming NIOC figures to be accurate in reporting crude runs to stills, the total refinery throughput in 1952 was just slightly more than domestic consumption average in Iran in the years prior to Anglo-Iranian's departure when its personnel accounted for a high percentage of domestic demand. For this purpose, however, domestic demand is estimated at 7.6 million barrels annually, the same rate as in 1950, though many observers believe local consumption in Iran is considerably less now. After allowance for this demand and NIOC reported refinery throughput, there remains a net withdrawal from product inventories of 972,674 barrels.

An analysis of the eight reported tanker liftings of oil from Iran through May 15 of this year shows that a total of 567,280 barrels were loaded, of which 363,280 barrels were reported to be crude oil and 204,000 barrels were reported to be refined products.

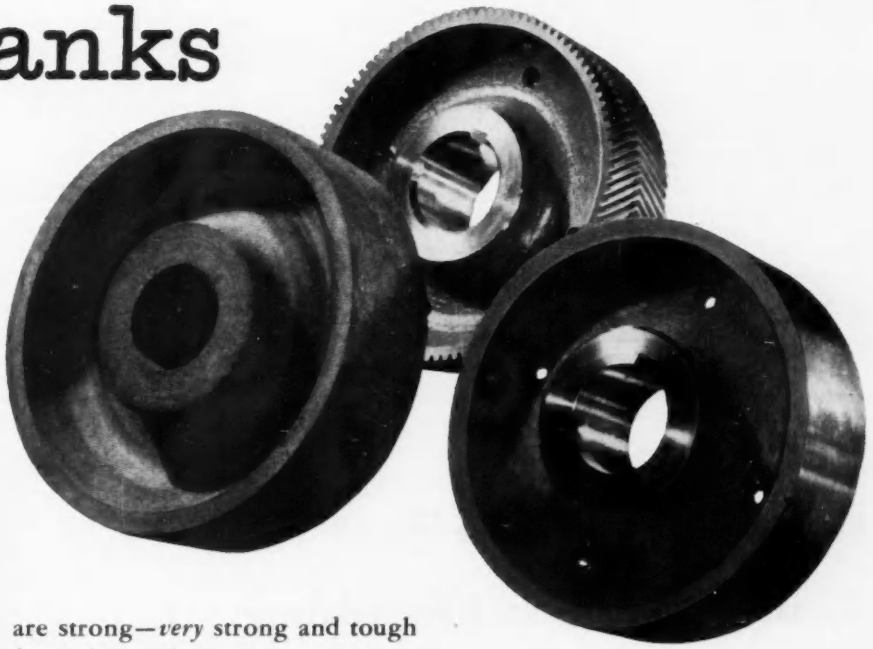
Deducting the shipments of 204,000 barrels of products (all of which occurred in 1953) from the net withdrawal leaves 768,674 barrels unaccounted for. If it can be attributed to "loss in storage," then the rate of loss is a little more than 6 percent, an unusually high rate. The total loss in storage in the U. S. last year was considerably less than 1 percent. Presumably, the crude oil tanker shipments came from storage at Bandar Mashur, since the rate of refinery runs in 1952, compared with net production, indicate NIOC withdrew some crude from storage to meet refinery needs.

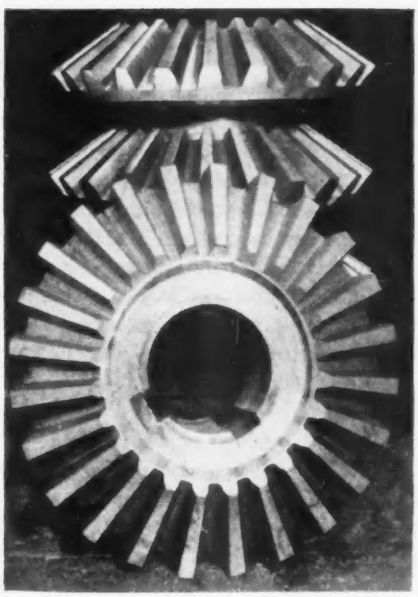
Regardless of the product and crude withdrawals, operation of the petroleum industry since expropriation is a tremendous letdown from the peak rate of 1950, Anglo-Iranian's last full year, when total production from 77 wells amounted to 204,849,000 barrels, or a daily average of 718,000 barrels, and refinery throughput at Abadan and Kermanshah was at rated capacity of 502,400 barrels daily.



Facts about some very strong gear blanks

Bethlehem makes gear blanks by a special process involving both forging and rolling—a process resulting in uniform density of metal and excellent grain flow. Because of the firm, solid steel all the way through, the blanks machine dependably and easily, with no hidden trouble down beneath. And they are strong—*very* strong and tough from rim to rim.





They are made in the only mill of its kind in the world. Available heat-treated or untreated, these sturdy Bethlehem blanks are unsurpassed for spur, bevel, miter, herringbone, and other types of gears. And you can get them in a wide range of sizes—approximately 10 to 42 in. OD.

Care for more details? We'll gladly furnish all you want . . . together with helpful Booklet 216, which is yours for the asking.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM ROLLED-and-FORGED CIRCULAR PRODUCTS

Wells Completed in the United States During April, 1953, and First Four Months, 1953

State or District	MONTHLY COMPLETIONS, APRIL, 1953 — NEW WELLS: Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Total New	Total Drilled Deeper	TOTAL COMPLETIONS: April, 1953	Mar., 1953	April, 1952	Footage April, 1953	CUMULATIVE TOTALS January-April: Wells 1953	Wells 1952	Percent Diff.	Footage 1953	Footage 1952	Rigs in Operation (Drilling, Rigging, Up and Shut Down): April 30, 1953	Mar. 31, 1953	April 30, 1952
Alabama	3			4				7		7	6	4	37,311	32	15	+113.3	171,558	76,811	8	6	7
Arizona														3			4,927		4	4	1
Arkansas	11		1	7				19	1	20	40	37	70,995	135	124	+ 8.9	483,783	460,570	30	26	43
California	151		5	52				208	8	216	233	217	849,162	874	866	+ 0.9	3,567,068	3,497,967	259	272	242
Colorado	13		10	18				41	1	42	38	30	186,016	167	128	+ 30.5	790,962	693,461	42	32	44
Florida				2				2		2	4		10,495	11	1	+1000.0	58,750	11,794	4	2	1
Georgia				2				2		2	1		3,126	3			7,808		3	3	
Idaho											1			1			12,720		1	1	1
Illinois	53			49				102		102	94	124	262,436	540	467	+ 15.6	1,358,824	1,130,535	173	153	178
Indiana	51		2	68				121		121	63	85	214,257	395	352	+ 12.2	711,077	629,369	140	132	158
Kansas	175		49	175			9	408		408	464	394	1,398,939	1,561	1,370	+ 13.9	5,388,838	4,755,773	454	491	485
Kentucky	29		15	42				86		86	87	85	169,340	315	323	— 2.5	611,403	656,431	91	91	110
Louisiana	90	5	22	68				185	1	186	177	180	1,443,100	784	728	+ 7.7	5,612,616	4,937,737	239	240	240
North Louisiana	30	1	11	26				68		68	62	96	274,563	326	388	— 16.0	1,206,191	1,448,087	44	50	60
South Louisiana	60	4	11	42				117	1	118	115	84	1,168,537	458	340	+ 34.7	4,406,425	3,489,650	195	190	180
Maryland				1				1		1	1	5	4,021	2	15	— 86.7	8,198	62,415	3	4	19
Michigan	17		2	18				37		37	44	67	114,060	172	213	— 19.3	466,029	570,952	91	80	91
Mississippi	6	1	1	26				34		34	21	23	219,860	119	127	— 6.3	844,065	911,121	25	27	31
Missouri				5				5		5		4	1,913	7	10	— 30.0	4,099	14,285	4		7
Montana	15		2	11				28		28	21	21	137,606	119	59	+101.7	575,811	173,361	54	49	60
Nebraska	13		1	20				34		34	19	14	173,698	97	61	+ 59.0	504,550	306,794	21	21	14
Nevada				4				4		4			5,082	5			5,892		1	3	1
New Mexico	54		30	10				94		94	109	100	611,266	459	356	+ 28.9	2,639,441	1,863,172	195	188	188
New York	39				26			65		65	69	84	91,243	281	280	+ 0.4	392,145	391,246	102	98	92
North Carolina																					
North Dakota	12			3				15		15	23	2	119,005	75	8	+837.5	595,908	71,883	27	28	17
Ohio	30		16	24				70		70	70	80	135,776	288	293	— 1.7	604,294	635,193	173	157	159
Oklahoma	312	2	22	170	2		3	511	8	519	679	448	1,831,830	2,238	1,865	+ 20.0	8,024,353	6,817,903	596	571	597
Oregon																					
Pennsylvania	60		10	2	48	10		130	1	131	118	145	226,868	497	524	— 5.2	863,796	896,664	245	243	254
South Dakota											2	1		2	1	+100.0	7,905	8,433	4	2	2
Tennessee																					5
Texas	833	17	81	561	2	2	1	1,497	10	1,507	1,385	1,588	6,761,474	5,601	6,341	— 11.7	25,422,767	30,257,813	1,379	1,417	1,724
Dist. 1 S. Central	33	1	1	37				72		72	60	54	251,080	260	227	+ 14.5	815,644	707,485	37	41	42
Dist. 2 Middle Gulf	25	6	14	34				79		79	73	79	474,047	260	291	— 10.7	1,564,312	1,817,098	52	56	67
Dist. 3 Upper Gulf	76	2	11	61				150	1	151	130	148	958,720	538	601	— 10.5	3,593,068	3,885,507	115	125	170
Dist. 4 L. Gulf-S.W.	83	3	17	47			1	151		151	142	171	843,512	638	613	+ 4.1	3,660,159	3,096,463	100	115	115
Dist. 5 E. Central	7		2	16				25		25	24	31	101,214	105	132	— 20.5	421,720	704,177	21	16	42
Dist. 6 Northeast	14	2	8	24				48		48	43	53	274,826	176	193	— 8.8	1,024,562	1,210,559	34	44	48
Dist. 7-B N. Cent	156		1	133				290	1	291	242	227	903,212	1,022	919	+ 11.2	3,292,081	2,991,055	128	132	166
Dist. 7-C W. Cent	86	2	1	45				134	4	138	109	172	688,492	494	778	— 36.5	2,445,417	4,576,078	150	153	243
Dist. 8 West	154	1	1	38				194	4	198	197	318	1,111,185	772	1,285	— 39.9	4,228,382	7,252,813	348	335	448
Dist. 9 North	177		1	126	2	2		308		308	321	281	1,011,419	1,168	1,070	+ 9.2	3,879,106	3,291,165	320	322	272
Dist. 10 Panhandle	22		24					46		46	44	54	143,767	168	232	— 27.6	498,316	725,413	74	78	111
Utah	1			2				3		3	11	5	7,747	27	22	+ 22.7	159,736	134,035	19	16	23
Virginia																					
Washington																			1		
West Virginia	5		34	15				54		54	46	61	145,789	187	204	— 8.3	507,949	603,961	188	181	200
Wyoming	42		1	18				61		61	53	55	302,552	201	202	— 0.5	988,685	1,029,886	85	73	99
Total U. S.	2,015	25	304	1,377	78	12	13	3,824	30	3,854	3,879	3,859	15,534,967	15,198	14,955	+ 1.6	61,395,957	61,599,565	4,661	4,611	5,093
Total W. Canada	66		11	51				128		128	154	105	559,122	615	493	+ 24.7	2,532,360	2,140,301	166	161	160

Lead Piled Up in First Four Months Is Shrinking

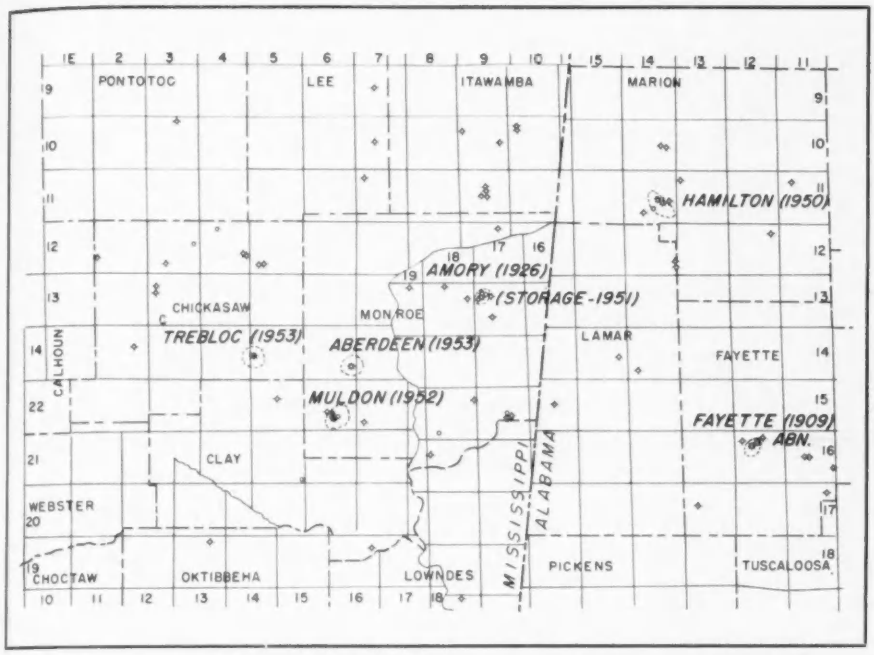
APRIL'S DRILLING activity showed little change from the preceding month, but by the end of the period there were a few more drilling rigs being put to use and some additional wells may be expected from them. Actually, the number of wells completed during the first four months of this year has been the greatest number ever drilled in any comparable period in history, but this lead is dwindling.

By the end of April, there had been 15,198 wells completed and that topped the previous January-April record set in 1952 by 243 wells or 1.6 percent. A month earlier the lead had been 282 wells or 2.5 percent, and it appears that the succeeding months will see this lead narrowed even farther or completely wiped out.

There are currently about 400 less drilling rigs at work than there were a year ago, and they have been doing almost as much work as last year's greater number. Although wells completed number slightly more this year, the amount of footage drilled in those wells was slightly less. Of course, footage drilled is a much better means of measuring the amount of work accomplished rather than counting wells, and so far this year the record is down, but only very slightly. Nothing on the order that might be expected from the shelving of 400 rigs.

While many rigs have been stacked, one can be assured that the idle ones are in all probability the most inefficient tools. Competition for the available contracts have caused the drilling industry to produce even more than it was called upon to do a year ago. Better equipment, techniques, and methods have been and are becoming more evident in this very competitive business.

Better bits, ones that drill faster, dull slower, and require less reaming after them, are playing no small part in this drilling speed up. More attention to the hydraulic systems of rotary rigs is also paying off in increased penetration rates. These are only a few of many factors that the progressive drilling contractor is calling upon to make faster hole these days.



Muldon discovery of 1952 has been followed by opening of Aberdeen and Trebloc fields.

Mississippi's Black Warrior Basin Yields Gas-Condensate

Reworking of abandoned wildcat results in productive well; other discoveries follow.

By FREDERIC F. MELLEN
Consulting Geologist, Jackson, Miss.

Beginning with completion of Union Producing Company's J. T. Sanders 1 in February, 1952, the Black Warrior Basin in Mississippi has had the astonishing discovery-ratio of 1 in 4. In relatively quick succession, discovery of the Muldon gas-condensate field was followed by discovery of Shell Oil Company's Aberdeen gas field and by discovery of the Carter Oil Company's Trebloc gas-condensate field. The three fields are productive in the Carter and Sanders sandstones of middle Chester (Mississippian) age. Not only is the discovery ratio almost fantastic, but most of the wildcat test wells which have been completed as "dry holes" are officially only "temporarily abandoned." Because of the great number of oil and gas shows and the difficulty of evaluating them, most test wells are left with surface casing and gate valves. Preparations are now being made to retest several such "dry holes."

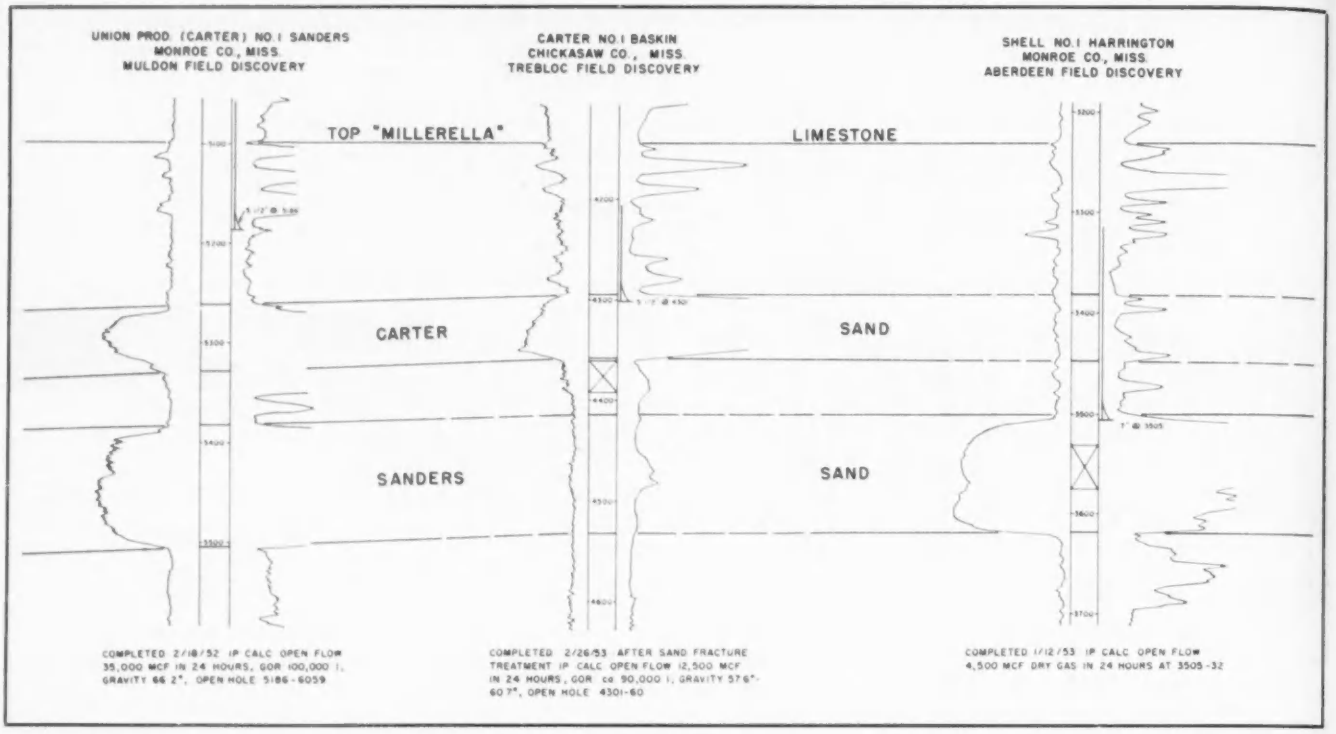
The caution and apprehension attendant upon the completion of a "dry hole" is understandable. In the first place the drilling cost is approximately 3 to 5 times the cost of a similar depth well drilled in Tertiary or Mesozoic rocks of central and south Mississippi. In the second place the numerous shows of oil and gas found in each well tax the operator's judgement as to which one of them might be the "pay." In the third place, the story of the Muldon field discovery is so well known that no operator would want that to happen to him.

In 1941, as part of a stratigraphic exploration program, the Carter Oil Company drilled and abandoned as dry its J. T. Sanders 1, 22-15s-6e., Monroe County, Mississippi. The elevation was 283 feet and the total depth was 6060. The well was drilled "tight," but after a number of months the leases were released and the electrical log and samples were made available to the industry. Rabbit hunters found that the ground was seeping gas over the well site and interested citizens uncovered the casing and equipped the well with a gate valve and flow nipple. For a number of years the well was a landmark with its small flare in still weather.

Part 1

Its volume was less than 15 mcf and its shut-in pressure was very low. In October, 1951, M. N. McCaskill and associates moved a small workover rig over this hole. On November 6, while cleaning out at 2900 feet the well blew out and the 2½-inch drill pipe dropped in. Union Producing Company was successful in dealing with the McCaskill group, assuming operation and one-half working interest (less ⅛th over-riding royalty to both assignee and assignor) of the well and in and to the 10,000-acre lease block. Reported cash consideration was $225,000. After several months of expensive and dangerous work with a larger rig, the well was cleaned out to 5215 feet and 5½-inch casing cemented at 5186 feet. The well was completed through open hole at a calculated daily rate of 36,000 mcf gas per day plus an estimated 10 to 15 barrels of 66.2° water white condensate per million cubic feet of gas.

All Records Are Broken. The present activity in the Black Warrior Basin has caused all previous records to be


UNION PROD. (CARTER) NO. 1 SANDERS
MONROE CO., MISS.
MULDON FIELD DISCOVERY
CARTER NO. 1 BASKIN
CHICKASAW CO., MISS.
TREBLOC FIELD DISCOVERY
SHELL NO. 1 HARRINGTON
MONROE CO., MISS.
ABERDEEN FIELD DISCOVERY
TOP "MILLERELLA"
LIMESTONE
CARTER
SAND
SANDERS
SAND
COMPLETED 2/18/52 IP CALC OPEN FLOW 35,000 MCF IN 24 HOURS, GOR 100,000 1, GRAVITY 66.2°, OPEN HOLE 5186-6059
COMPLETED 2/26/53 AFTER SAND FRACTURE TREATMENT IP CALC OPEN FLOW 12,500 MCF IN 24 HOURS, GOR cc 90,000 1, GRAVITY 57.6°-60.7°, OPEN HOLE 4301-60
COMPLETED 1/12/53 IP CALC OPEN FLOW 4,500 MCF DRY GAS IN 24 HOURS AT 3505-32

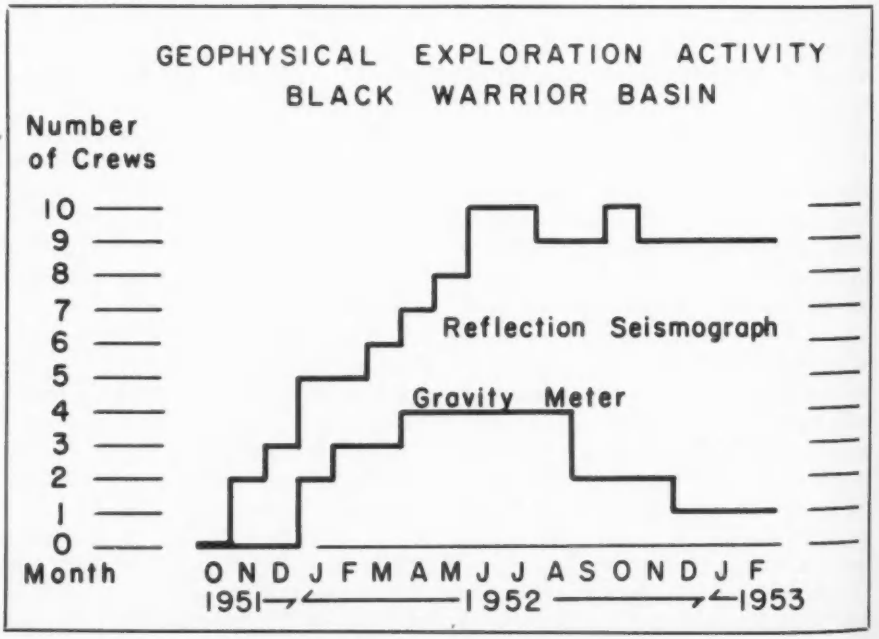
Electrical logs of three discovery wells reveal productive possibilities in Carter and Sanders sandstones of middle Chester (Mississippian) age.

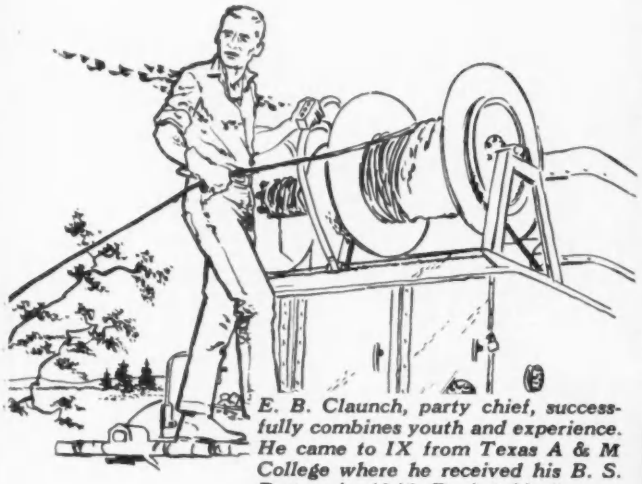
broken and has set up a number of "firsts."

- The old Amory Field (1926) which was the first producing area in Mississippi has been successfully converted into the first gas storage reservoir in Mississippi.
- The Union Producing Company Sanders 1 is the first producing well of liquid hydrocarbons in the Black Warrior Basin.
- In volume, the Sanders 1 has a potential approximately seven times greater than any previous gas well in the basin.
- The number of acres under lease is several times greater than at any other period.
- There are more geophysical parties working in the area than at any earlier time.
- Over 20 oil and gas companies have been actively engaged in the purchase of leases. In earlier plays one or two larger companies made aggressive starts and were followed by a few cautious satellites.
- In three wells Union Producing Company cored the entire Mississippian completely as well as hundreds of feet of overlying Pennsylvanian and other hundreds of feet of underlying Devonian.
- The Carter Oil Company has demonstrated the first materially successful sand fracturing treatment for increasing productivity of its Baskin 1.
- The money spent in drilling during 1952 exceeded by far the maximum amount ever spent in a single year.

Geology Is Complex. The geology of the Black Warrior Basin is complex structurally as well as stratigraphically. Drilling to date is insufficient to show the relationship of the productive reservoirs to structural features. Shell's Harrington 1, dry gas discovery well of the Aberdeen field, is only six miles northeast of Union's Sanders 1, gas-condensate discovery of the Muldon field. Both wells produce from the same sand (Sanders) but at sub-sea depths over 1800 feet apart. The Muldon, Aberdeen and Trebloc fields lie in a structural belt where the south-southwest dip averages 300 feet per mile. Faulting is known from drilling as well as from seismographic mapping.

Following the Muldon discovery the





E. B. Claunch, party chief, successfully combines youth and experience. He came to IX from Texas A & M College where he received his B. S. Degree in 1946. During his 6 years with IX he has performed many of the important duties on a geophysical crew.

Independent's EXPERIENCED Party Chiefs Pay Exploration Dividends

With an average of 16 years service in the exploration field, Independent's Party Chiefs have the professional knowledge needed to best serve you. Exploration dividends are yours when you place your confidence in the experience and knowledge of Independent's Party Chiefs and their crews.

Founded in 1932, Independent has made successful surveys in 26 states and foreign countries. More than 100 major oil producers have been served profitably by Independent Exploration Company.

POINTING THE WAY FOR THE DRILL

IXC

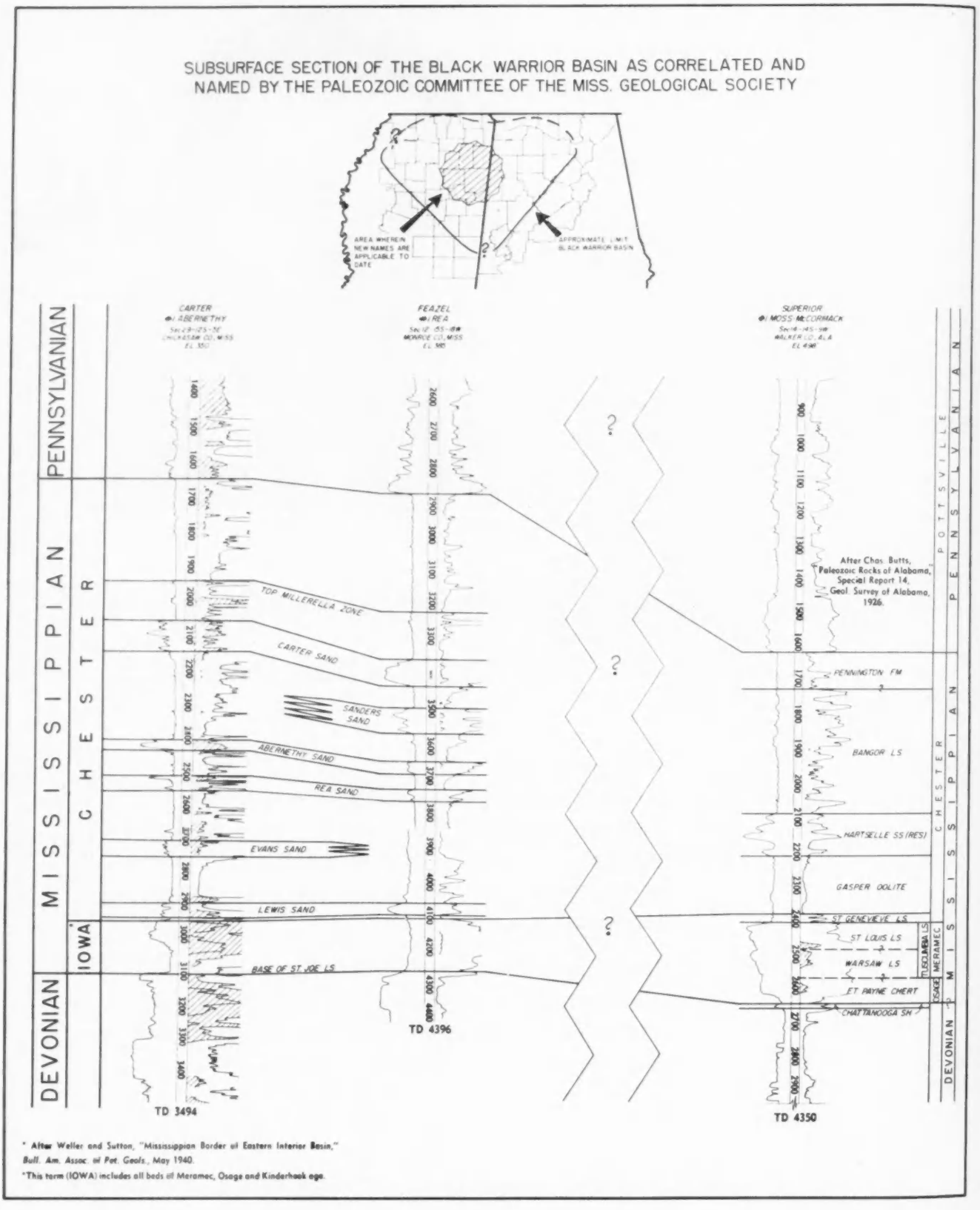
Independent's Experience Merits Your Confidence

Independent *Geophysical Surveys*

EXPLORATION COMPANY

1973 WEST GRAY ★ HOUSTON, TEXAS

ESTABLISHED 1932



* After Weller and Sutton, "Mississippian Border of Eastern Interior Basin," *Bull. Am. Assoc. of Pet. Geols.*, May 1940.

*This term (IOWA) includes all beds of Meramec, Osage and Kinderhook age.

number of seismograph crews increased steadily to a maximum of 10 and has levelled off at nine. The number of gravity meter crews reached a maximum of four during the summer of 1952 and has decreased to one in February, 1953. It is expected that as the importance of gravity is realized there will be a sharp increase in number of crews. Both airborne and ground magnetic instrumental surveys have been made in recent months, but these surveys were not reported through regular reporting channels. There has been

emblem

of experience

2200* man-years of it-

Wherever there is exploration activity, you will see this emblem. In announcing its Awards Program, GSI pays tribute to the achievement of its people. Their collective ability is GSI's greatest single asset . . . out of which has developed the stability and experience that characterize GSI.

*

Awards This Year	Years of Experience
11	More than 20
34	More Than 15
26	More Than 10
123	More Than 5
Total 194	More Than 2200

GEOPHYSICAL SERVICE INC.

6000 LEMMON AVENUE • DALLAS, TEXAS

some core-drill work. At least two surface geology parties are working in the Paleozoic outcrop area of north-central Alabama.

The complexity of the Black Warrior Basin is the key to its present 1 in 4 discovery ratio. The fact that most of the strata are tight and impermeable is the reason that gas and oil can be confined beneath the overburden. This is the reverse condition to that found in the Comanchean and Cretaceous rocks of south Mississippi and south Alabama where the ratio of sand to shale is extremely high. It is the condition, however, where offshore bars can develop, where permeable sands can wedge out updip, and where any degree of faulting or folding can exert a maximum influence on the accumulation of pools of gas and oil. Several important unconformities, especially that at the top of the Devonian, offer promise of large reservoirs which can be found by drilling, aided by sub-surface geological studies.

Names of Sands Adopted. The Paleozoic Committee of the Mississippi Geological Society realized the widespread misuse of sand names and saw the necessity of assigning names to be used in referring to potential reservoirs. Since the clastic Chester sediments were of greatest immediate importance, the studies were limited to that series of rocks which includes all of the sands productive to date in the Paleozoic rocks of Mississippi. The practice of using farm names for sands was accepted by the Committee. As a general rule, an electrical log must be available, and the name selected is of a well in which the sand is first productive or in which it is well-developed. Six Chester sandstones have thus far been designated by the Committee and adopted by the society.

Black Warrior Basin

Analyses of Natural Gas

	1	2	3	4
Carbon dioxide	0.19	.15	0.00	0.20
Methane	86.62	96.92	95.50	99.00
Ethane	6.94	1.41	3.00	0.00
Propane	2.63	.....	.....	.....
Isobutane	0.39	.....	.....	.....
N-butane	0.67	.....	.....	.....
Isopentane	0.13	.....	.....	.....
N-pentane	0.14	.....	.....	.....
Hexane	0.05	.....	.....	.....
Heptanes-plus	0.07	.....	.....	.....
Nitrogen	2.17	1.44	1.20	0.80
Oxygen	.....	0.08	0.30	0.00
Helium	.....	0.12	.....	.....
Totals	100.00%	100.12%	100.00%	100.00%
B.t.u.	1,097 (wet)	998	1,020	.....
Specific gravity	.648	.57	.....	.554

1. Union Producing Co. (formerly Carter Oil Co.) No. 1 Sanders, Muldon Field, Monroe County, Mississippi. Well also produces 10-15 barrels 66.1° condensate per M²CF. Carter & Sanders sands, Chester; depth below 5,000 feet.

2. Amory Petroleum Co. No. 1 Carter, Amory Field, Monroe County, Mississippi. Carter sand, Chester; depth 2,400 eet.

3. Mellen & Gear No. 1 Wood, Tishomingo County Mississippi. Black River, Ordovician limestone; depth 1,053 ft.

4. H. L. Cullet No. 1-A Lewis, Hamilton Field, Marion County, Alabama. Lewis sand, basal Chester; depth 1,825-35 feet.

Geologic Setting of Black Warrior Basin. The Black Warrior Basin is a structural basin lying between the opposing (?) Appalachian and Ouachita orogenies (y) which intersect acutely near the Mississippi-Alabama State Line at, or just north of, the 32nd parallel. It is an unique triangular basin whose acute southern tip lies in Lauderdale or northern Clarke County, Mississippi and whose (arbitrary) northern boundary extends westward from the Sequatchie anticline on the Alabama-Tennessee state line to the vicinity of Memphis on the Mississippi River. It is genetically associated (orogenically and depositionally) with the McAlester-Arkansas Valley Basin, the Cumberland Plateau geosyncline of east-central Tennessee and the corresponding belt which extends through eastern Kentucky, and Ohio and western West Virginia and Pennsylvania into New York. It may be related, similarly, to the Anadarko-Dodge City Basin.

As now revealed, the Black Warrior Paleozoic Basin is a conspicuous structural trough, bounded on the southeast by the sharp linear folds and compressional faults of the Appalachian system, and on the southwest by the sharp folding and compressional faults of the Ouachita system and on the north by the broad "complimentary" arches of the Cincinnati-Nashville-Ozark chain. This double compression produces a complex geosyncline having structural trends aligned in northeast-southwest and northwest-southeast directions, roughly normal to one another, roughly similar to the classic illustration of tensional cracks developed in twisting a pane of glass. These second and third order structures may be expressed as folds, or as faults having vertical displacement of a few feet to over 1000 feet.

The nonconformity at the base of the Mesozoic has been mapped in a crescentic belt from the northeast corner of Mississippi southeasterly into Alabama. In the north basal Eutaw rests upon lower Mississippian or middle Devonian. To the southeast upper Tuscaloosa, then lower Tuscaloosa strata, rest across the truncated Mississippian, Pennsylvanian, or, in the more complex areas upon whatever rocks are present, whether they be Cambrian, Pre-Cambrian, or igneous rocks of the southern Appalachian mountains.

(First of Two Parts)

About the Author

FREDERIC F. MELLEN, consulting geologist, Jackson, Miss., discovered and mapped the Tinsley Dome, Yazoo County, Mississippi, in February, 1939. This was developed into the first commercial oil field in Mississippi in September, 1939, by Union Producing Company. He has made a particular study of the Paleozoic rocks of northeastern Mississippi, Alabama and Tennessee, on which he has previously published several articles and given numerous talks. Mellen received his B.S. degree at Mississippi State College and his M.S. at the University of Mississippi. He has been president of the Mississippi Geological Society (1946). He worked for the Tennessee Valley Authority, the Mississippi Geological Survey (assistant state geologist), Work Projects Administration, Agricultural Adjustment Administration, Eastern Clay Products, Inc., and British-American Oil Producing Co. He has been a consulting geologist since 1940 except for 20 months.

Operators Everywhere Tell Us . . .

"NOTHING ELSE can do the jobs a BAASH-ROSS SAFETY CLAMP will handle!"

IT PROTECTS . . . drill collars, flush pipe, tubing, etc., from dropping through the rotary table.

IT LIFTS . . . casing, liners, drill collars, pipe, tubing—even twist-offs—as temporary elevators.

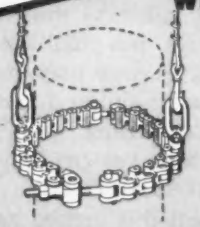
IT SNUBS . . . drill pipe and tubing against upward movement when cementing, working under pressure, etc.

IT PULLS . . . pipe sections and similar cylindrical products horizontally for aligning, positioning, welding.

Regular Size Safety Clamp (Type CR), above, fits diameters 3¾" to 10⅝". Large Size (Type CL) fits diameters 11½" to 15½". Extra Large Size (Type CXL) fits diameters 15½" to 21". Tubing Size (Type T) fits diameters 1⅛" to 4½".

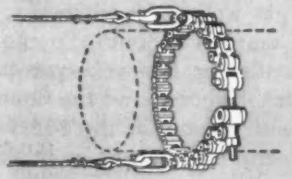
HERE THE SAFETY CLAMP (Regular size) is used to prevent drill collars and similar flush joint equipment from dropping through slips in the table. It is ideal for use with Baash-Ross Drill Collar Slips to give **double** protection against slipping!

WIDE ADAPTABILITY



FOR LIFTING casing, pipe, liners or tubing, the Safety Clamp is equipped with lifting ears through which a sling can be fastened to substitute for elevators. The Extra Large Size shown here fits casing up to 21" in diameter!

FOR SNUBBING drill pipe and tubing, the Safety Clamp is simply inverted so the slip segments pull down instead of up. Easily-attached hold-down ears permit fastening anchoring cables with maximum speed and simplicity.



FOR PULLING pipe lines or pipe sections into alignment for welding, coupling or positioning, a Safety Clamp fastened around the pipe provides a slip-proof grip for pulling manually or mechanically.

Get Complete Details on the many ways Baash-Ross Safety Clamps can increase the safety and efficiency of your rig operations. Your local supply dealer will gladly supply full information —or write direct!

There seems to be no limit to the variety of jobs operators have figured out for the Baash-Ross Safety Clamp. Originally designed to take a quick, slip-proof grip on drill collars, liners and other flush joint equipment to prevent it from dropping through the table, it is now available in four sizes—Tubing, Regular, Large and Extra Large—to lift equipment *up* . . . or hold it *down* . . . or pull it *sideways. In fact, wherever you have a job calling for a firm grip on anything cylindrical—from only 1⅛" in diameter to 21"—the Baash-Ross Safety Clamp will probably do the job easier than you ever thought possible!*

HERE'S THE GRIPPING PRINCIPLE IN A NUTSHELL

The Safety Clamp consists essentially of many individual links flexibly hinged together. Each link has a tapered slip held in retracted position by a spring. When the Clamp is tightened around the pipe—a quick and simple operation—each slip takes a firm initial grip on the surface of the pipe. As the load increases, each slip is wedged tighter, preventing any slippage between pipe and Clamp. There's no risk of crushing thin-walled pipe or damaging pipe surfaces because the grip is *uniformly distributed around the full circumference.* And since each link is interchangeable as a unit, simply adding or removing links readily adapts the Clamp to virtually any diameter pipe in common use.

Baash-Ross

TOOL COMPANY Our 33rd year

Baash-Ross Safety Clamps are available through leading oil field supply dealers.

GENERAL OFFICES: 5512 SO. BOYLE AVE., LOS ANGELES 58
OKLAHOMA CITY 9 • HOUSTON 20 • ODESSA • CASPER
Export Offices: 11 W. 42nd St., New York 36

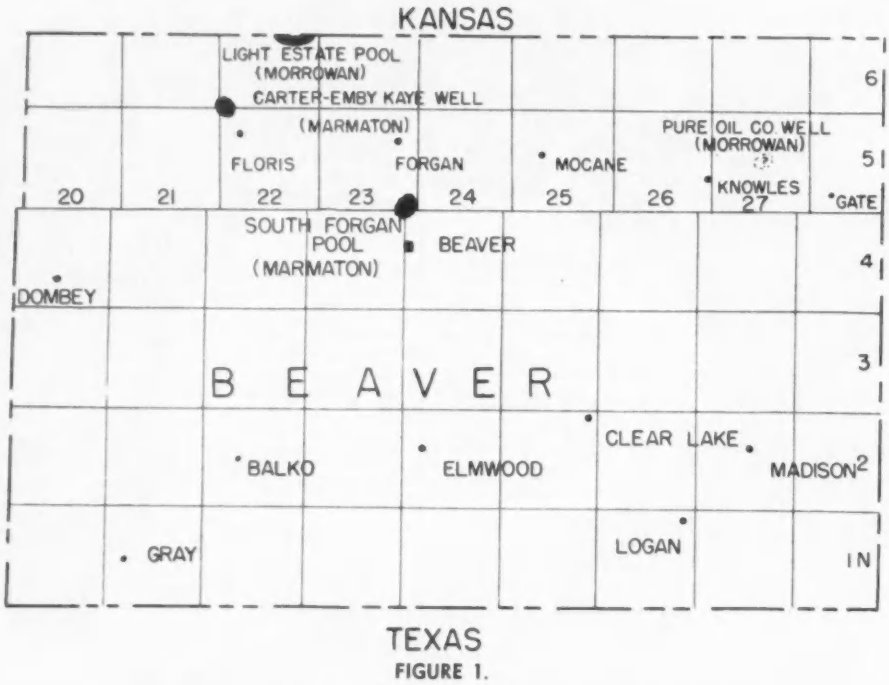


FIGURE 1.

Location map of oil and gas pools in Beaver County, Oklahoma.

What Are the Possibilities In Beaver County, Oklahoma?

Recent developments have indicated the existence of important oil-bearing structures.

By WAYNE H. GRIMES
Geologist, New Orleans, La.

RECENT DEVELOPMENTS in Beaver County, Oklahoma, are attracting attention of oil men to that wind-blown section in the Oklahoma Panhandle. Although it is too early to evaluate the area's future prospects, it seems most likely that Beaver County, in time, will become one of Oklahoma's important oil-producing provinces.

Most significant recent developments are The Carter Oil Company's extension of the Greenough pool in 5-5n-22ecm, and J. M. Huber Corporation's recent discovery at its Potter 1, CSE NW 26-6n-21ecm, between the Greenough and Light Ranch pools. The Huber discovery is of major significance since it is located three miles northwest of the Greenough pool. If this strike proves a three-mile extension of Greenough, where four wells are producing at this writing, it will indicate the existence of at least one important reservoir. And where there is one such reservoir, who can deny that many more may be found.

Beaver County lies in the east end of the Oklahoma Panhandle and encompasses approximately 1768 square miles. It is an area of little relief including high plains, sand dues, breaks and valleys. The surface slopes gently to the east approximately 12½ feet per mile, but is interrupted by the valleys of the Cimarron and Beaver rivers. The total amount of relief is approximately 200 feet.

Two major geological considerations make Beaver County attractive from an oil and gas exploration standpoint:

1. Ideal reef-building conditions prevail where the deeper portion of the Anadarko Basin changes abruptly to a structural platform along the county's southern boundary.
2. It offers both structural traps and sedimentary wedges in Pennsylvanian and Mississippian rocks.

History and Development. Drilling in Beaver County dates from the early 1920's but has been very sporadic. Its remoteness from other producing areas in Oklahoma may account for this. Early wildcat tests were drilled with standard tools and were shallow, penetrating only the Permian strata. There have been two periods of exploration in the general area. The first covered the period from 1926 to 1931. This was based largely on evidence of surface structure together with a small amount of core drilling, magnetometer and torsion balance work.

The second period, which was based on subsurface seismic and core drilling information, began in 1935 and has been gaining intensity till the present. One reason why so few wells have been drilled in Beaver County is that exploration techniques have thus far failed to provide adequate reasons for pin-pointing prospective locations. Surface mapping is not reliable, as structures found are often superficial. Seismic work, due to the shallow high velocity beds, is for the most part unsatisfactory.

Production is limited to the following areas: a small gas distillate pool on the Kansas border in the northwestern part of the county known as the Light Estate area: The Pure Oil Co.'s gas well in 15-5n-26ecm; Flynn Oil Company's South Forgan pool, reportedly the first reef-type production in Oklahoma and the Greenough pool with its possible three-mile extension mentioned earlier in this article.

Stratigraphy. Beaver County lies on the north and west flanks of the Anadarko Basin. The formations represented are few and do not show any great movements or intense folding or faulting, such as have occurred in many parts of Oklahoma. Surface rocks belong to three geologic ages:

Quaternary, Tertiary and Permian, with the possibility of some Cretaceous being present in isolated areas.

The Permian system ranges in thickness from 3900 feet in the southern and eastern part of the county to 3500 feet in the northwestern part. This thinning of the Permian in a north and westward direction is due to onlap of the Permian over the underlying Pennsylvanian strata with depositional conditions being responsible for local variations in thickness. The Permian rocks are principally continental in character and include red shales, sandstones, dolomite, salt, anhydrite and gypsum.

Pennsylvanian strata thus far have been the source of commercial production in Beaver County. Thick sections of limestones are encountered throughout the system with an important sandstone (Morrowan) found near the base.

The Pennsylvanian reservoirs include the basal sand of the Morrowan group, a lower member of the Marmaton group, and a reef-like limestone near the top of the Marmaton group. The Light Estate area produces gas-distillate from basal Morrowan lenticular sands; South Forgan produces from the reef-like limestone of Marmaton age and the Greenough pool produces from the Oswego lime (lower Marmaton).

CORRELATION CHART

System	Series	R. R. Wheeler 1947	R. H. Dott 1948	J. C. Maher 1948	G. L. Meholin 1950	Compiled for this Thesis 1952
PERMIAN	Guadalupian	Undifferentiated Upper Permian evaporitic sequence	Whitehorse group: Quartermaster fm. Cloud Chief fm.; Rush Springs ss. Marlow fm.	Taloga fm. Day Creek dol. Whitehorse ss.		Cloud Chief fm.; Whitehorse group: Rush Springs Marlow
	Leonardian		El Reno group: Hennessey sh. Garber ss. Wellington fm.	Nippewalla group: Blaine fm.; Sumner: Stone Corral dol. Minnescah sh.	Wichita; Albany	El Reno group: Dog Creek sh. Flowerpot sh. Blaine gypsum; Enid group: Hennessey sh. Garber ss. Wellington fm.
	Wolfcampian	Chase; Council Grove	Pontotoc	Chase Council Grove Admire: Foraker	Chase	Chase Council grove Admire
PENNSYLVANIAN	Virgilian	Wabaunsee; Shawnee	Pawhuska fm. Elgin ss.	Shawnee	Wabaunsee Shawnee Topeka Douglas Hoover	Wabaunsee Shawnee Douglas
	Missourian	Missouri Series	Hoxbar-Canyon (Ardmore Basin): Ocholata group: Avent ls.; Skistook group: Dewey ls. Nellie Bly fm. Hogshooter ls. Coffeyville fm. Seminole fm.	Lansing; Kansas City; Bronson	Lansing; Kansas City (Cleveland ss.)	Kansas City-Lansing
	Des Moinesian	Marmaton; Cherokee	Deese formation (Ardmore Basin): Lenapah ls. Nowata sh. Oologah fm. Labette sh. Fort Scott ls.; Cherokee group	Marmaton; Cherokee	Marmaton (Ft. Scott); Cherokee	Marmaton; Cherokee
	Atokan	Morrow	Upper Dornick Hills fm.: McAlester fm. Hartshorne ss. Atoka fm.	Atokan-Morrowan	Atoka	Atokan-Morrowan
	Morrowan		Wapanucka fm. Union Valley fm.		Morrow	
	Springeran		Springeran			
MISSISSIPPIAN	Chesterian	Mississippian (Zoned)	?	Chesterian	Chester	Chesterian
	Meramecian		Caney sh.	Ste. Genevieve St. Louis ls. Warsaw ls.	Ste. Genevieve St. Louis ls. Warsaw ls.	Ste. Genevieve ls. St. Louis ls. Spergen ls. Warsaw ls.
	Osagian		Mayes Sycamore ls.	Keokuk and Burlington ls.	Osage	Osagian Zones "A," "B," "C"
	Kinderhookian		Woodford sh.	Gilmore City ls. "Misener sand"	Kinderhook	Kinderhookian
Sil.-Dev.			Hunton group		Hunton group	
ORDOVICIAN	Cincinnatian Mohawkian Chazyan Beekmantownian	Cambrian and Ordovician: Maquoketa Viola ls. Simpson group Arbuckle	Sylvan sh. Viola ls. Simpson group Arbuckle	Viola ls. Simpson group Arbuckle	Sylvan sh. Viola ls. Simpson group Ellenberger	Viola ls. Simpson group Arbuckle
Cambrian						

R. R. Wheeler, "Anadarko Basin—Oil and Gas Possibilities," **World Oil**, Part 2, (September 29, 1947).
R. H. Dott, "General Geologic Section of Oklahoma Oil Producing Areas," **National Oil Scouts and Landman's Yearbook**, Vol. 18 (1948), p. 454.
J. C. Maher, "Subsurface Geologic Cross Section from Baca County to Yuma County, Colorado," **Kan. Geol. Surv.**, Prelim. Cross Sec. No. 6 (1948).
G. L. Meholin, "Recent Geological Developments in Western Anadarko Basin, Texas and Oklahoma Panhandles," **Bull. Amer. Assoc. Petrol. Geol.**, Vol. 34. No. 7 (July, 1950), p. 1534.

FIGURE 2.

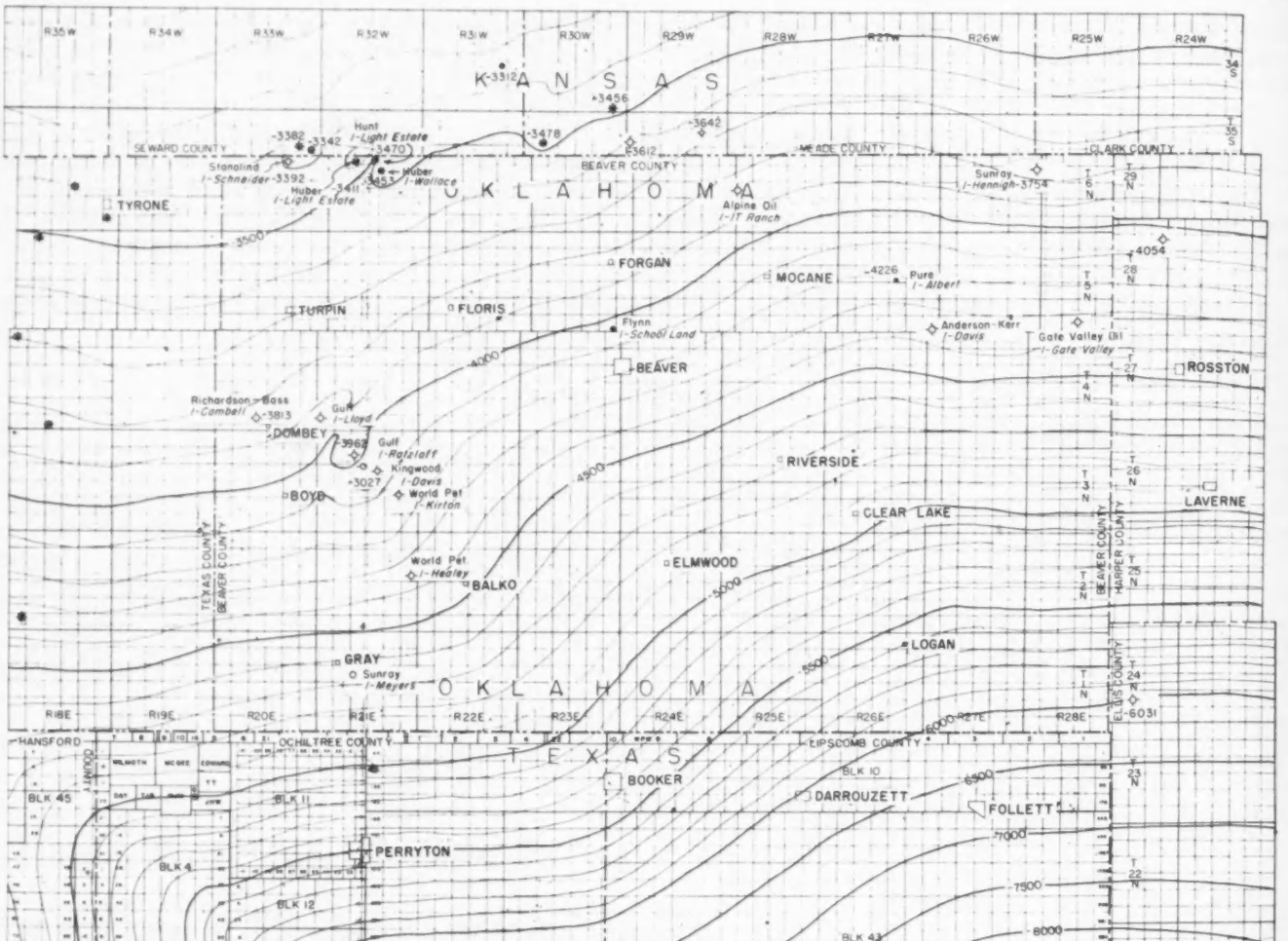


FIGURE 3.

Structure map Top Marmaton Group of Beaver County, Oklahoma. Contour interval—100 feet. Datum—sea level. Scale: 1 inch—4 miles.

Possible Oil and Gas Reservoir. Rocks of the Virgilian series (upper Pennsylvanian) offer little encouragement for future production, although some of the thick limestone members near the top offer remote possibilities.

The Missourian series offers possibilities throughout its approximately 1000 feet of limestones. On structures it should be a very important producing horizon. Flynn Oil Company's School Land 1, 35-5n-23ecm, South Forgan pool opener, had favorable oil showings on numerous tests in the Kansas City-Lansing (Missourian) section. Because of the location with respect to the platform area, future drilling may reveal Missourian reefs extending from northern Beaver County into southern Kansas, striking approximately northeast and southwest. The importance of such a reef needs no emphasis.

Des Moinesian strata offers very good future possibilities. The School Land 1 (South Forgan pool), produces from this series. However, a test drilled about ¼ mile south of this well found water in the same horizon. Possible commercial production may be found to the north where the formation will be higher on structure.

Carter-Emby Kaye's Sharp 1, 31-6n-22ecm, Greenough pool opener, located a well developed limestone in the lower Marmaton section which produced commercial oil. Such sporadic productive zones may be present throughout the Des Moinesian series where the shaly limestones of the southern part of the county undergo a facies change into coarsely crystalline, cherty limestones south of the Kansas-Oklahoma border.

Basal Pennsylvanian sand production has been the primary objective of drilling in this area. This basal sand is referred to as Morrowan by geologists in this northwestern area, although the writer prefers to identify it as Atokan-Morrowan. It has been a prolific gas and distillate producer in Beaver County and southwestern Kansas. The trend of this sandstone is still problematical, being found highly developed in certain wells in the area (Light Estate area, T 6n-23ecm and missing completely in other wells. This sandstone member possesses all the characteristics of a lenticular unit.

Mississippian possibilities are as important as those associated with Pennsylvanian strata. The Chesterian series is perhaps the most lucrative objective because of the pronounced thinning

Now!

Security's

NEW NEO-RED

RUBBER STABILIZER

Insures Maximum Drill-String Stabilization

Developed and perfected to meet the urgent need for maximum stabilization with today's high drilling speeds, and heavier weights encountered in deep well drilling, the *new* Security Neo-Red Rubber Stabilizer introduces a field-proven method of stabilization that is unsurpased in safety and efficiency.

Briefly, the Security Neo-Red Rubber Stabilizer consists of a 6-foot integral forged steel mandrel with an 18-inch rubber sleeve mounted on the recessed portion of the mandrel. The circular sleeve consists of an oil and temperature resistant rubber moulded over two forged-steel half sections. The metal portion of the sleeve fits inside the recessed portion of the mandrel, with only the rubber extending past the O. D. of the mandrel.

The rubber sleeve floats on the mandrel, providing a wide surface contact to the hole wall, thereby resisting any lateral movement of the drill collars. Stabilizer is easily mounted in drill-string and sleeve can be changed in a matter of minutes right at the rig by only one man. No welding or special tools are required to change sleeves.

Write for Bulletin 130

A multi-colored 4-page bulletin describing the new Neo-Red Rubber Stabilizer in full detail is available upon request. Send for your copy today.

Look at these Field-Proven Features . . .

1 FLUTED CHANNELS

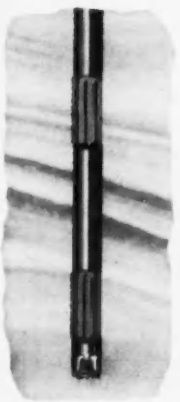
Channels on interior of sleeve permit cuttings to circulate without being hung-up. Scalloped channels on cylindrical exterior insure full circulation, prevent mud and cuttings from lodging between sleeve and formation. Sleeve floats on mandrel, performs no cutting action.

2 FAST CHANGE OVER TIME

Each of the two lightweight sleeve sections has metal tongue and groove to facilitate ease in mounting and removing sleeve right at the rig. Sections are securely joined by seven studs on each side.

3. SOLID ONE PIECE MANDREL

Cut from solid steel forging for maximum strength and safety, this 6-foot mandrel has recessed area for mounting rubber sleeve firmly in position.



Designed to operate in the open hole, this revolutionary new Security Neo-Red Rubber Stabilizer assures you of maximum drilling efficiency and provides a safety margin heretofore unobtainable in steel stabilizers.

Security ENGINEERING DIVISION

DRESSER OPERATIONS, INC.

Main Office: Whittier, California *Plants:* Whittier, Calif.—Dallas, Texas
Export: Chanin Bldg., N. Y. C. Branches in all major producing areas

Security ENGINEERING DIVISION
12920 Whittier Blvd., Dept. SR
Whittier, California

Please send me at once, bulletin on the Security Neo-Red Rubber Stabilizer

Company_____

Name_____

Address_____

City_____ Zone____ State_____

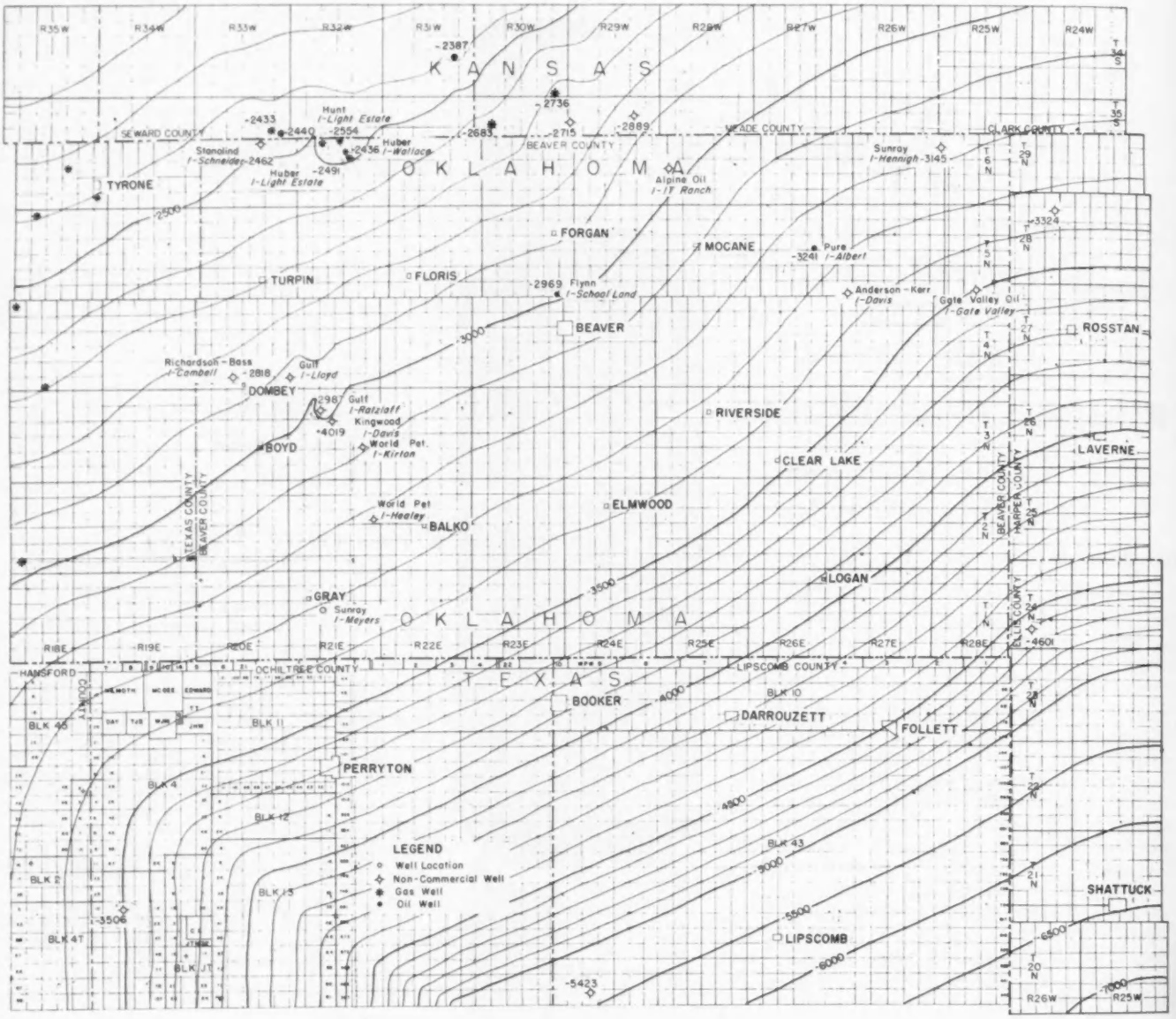


FIGURE 4.
Structure map Top Chesterian Series, Beaver County, Oklahoma. Contour interval—100 feet. Datum—sea level. Scale: 1 inch—4 miles.

and facies changes to the north. The series is characterized by sandy, dolomitic, porous, oolitic, fossiliferous limestone and cherty zones which offer ideal reservoir conditions when afforded the proper trap. Across the northwestern part of the county, striking in a northeast-southwest direction, individual members of the Chesterian series wedge out due to the existing onlapping condition forming subsurface hogbacks sealed by early Pennsylvanian deposition.

Mermaceian strata display needed permeability and are potential reservoirs under proper structural conditions. However, the writer considers them of less stratigraphic importance than the Chesterian series.

Lower Mississippian (Osagian and Kinderhookian) rocks do not display a great deal of permeability in Beaver County and are considered less favorable objectives.

About the Author

WAYNE H. GRIMES received his B.S. and M.S. degrees in geology from the University of Oklahoma. He is now with The California Company in Harvey, La., as a development geologist.

Ordovician possibilities in Beaver County appear poor at this writing and not considered favorable objectives. The Ordovician does not display oil staining in any of the wells that have thus far been carried to that horizon. However, a show of oil was reported in beds of the Simpson and Arbuckle groups in Stanolind Oil and Gas Company's Wheatley 1, 23-33s-31w, in Seward County, Kansas.

Conclusions. From a detailed subsurface study of Beaver County, the following conclusions may be drawn: Beaver County is located in a structural province commonly referred to as the Hugoton embayment. This is a northwest extension of the regional geosyncline known as the Anadarko Basin.

The surface stratigraphy of the area includes rocks of Tertiary and Per-

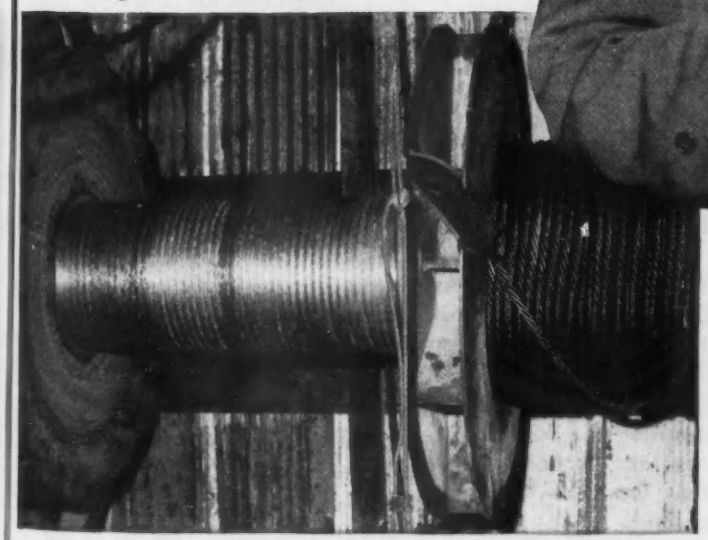
cable tool well drilled Tiger Brand Tapered Wire Line

under the extreme abrasive wear encountered in this deep well. They are performing so well that the New York State Natural Gas Co. has ordered *another* identical Tiger Brand Tapered Drilling Line for use when the present one eventually wears out.

American Wire Rope Engineers can design a suitable wire rope for *any* special job you may have. And when they do the engineering, you can be sure of getting just the right combination of strength, durability and flexibility. Get in touch with the nearest sales office for their help.

MEASURING THE DIAMETER of the drilling line to check for wear. This special Tiger Brand Line is holding up so well that New York State Natural Gas Co. has already ordered another Tiger Brand Line just like it.

THIS IS THE BULL WHEEL WITH the 1" section of drilling line still wound on it. This line tapers from 1" down to ¾" at the tool end. Additional strength and diameter is needed at the top to support the weight of the line and tools.



FOR THE EVERYDAY JOBS, GET THIS HANDY GUIDE BOOK

Most of your tough rope jobs can be handled efficiently with one of the several hundred *standard* Tiger Brand Wire Lines. This "Wire Rope Recommendation Book" tells you which one to use for each job . . . helps you get the *right* rope every time. Just send the coupon.

American Steel & Wire
Dept. Q-63, Rockefeller Bldg.
Cleveland 13, Ohio

Please send me, without obligation, a copy of your "Wire Rope Recommendation Book."

Name.....

Company.....

Address.....

City & State .....

AMERICAN STEEL & WIRE DIVISION
UNITED STATES STEEL CORPORATION, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS TRADE MARK

U·S·S AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

UNITED STATES STEEL

All business is specialized

. . . and nothing specializes on your business like your business paper

This sea-going salesman can sell more . . . because he *specializes*. Your business, too, is specialized. That's why it pays to keep up with this business paper of yours that specializes on the business problems you meet daily. You can *move ahead* when you know what's ahead; you can make quick decisions when you have a clear perspective. Follow the editorial features that gather, weigh and interpret the news . . . and ads that report new products, materials and equipment—what they do—where to buy them. Read *every* issue . . . thoroughly.

This business paper in your hand has a plus for you, because it's a member of the Associated Business Publications. It's a *paid* circulation paper that must *earn* its readership by its quality . . . And it's one of a leadership group of business papers that work together to add new values, new usefulness, new ways to make the time you give to your business paper still more profitable time.

Coming—AUGUST 15

International Operations—Atlas Issue

combined with

Mid-Year Outlook

Make your extra copy reservations now. Write WORLD OIL Circulation Dept., P. O. Box 2608, Houston 1, Tex.

One of a series of ads prepared by THE ASSOCIATED BUSINESS PUBLICATIONS

mian ages, with Quaternary alluvial deposits found along the streams. The Permian outcrops consist principally of red shales and sandstones interbedded with gypsum.

Upper and middle Permian (Guadalupian and Leonardian) rocks of the area are predominantly continental deposits with the frequent presence of evaporitic deposits indicating the presence of inland seas.

Lower Permian (Wolfcampian) is represented in this area by persistent limestone members interbedded with shales.

The Virgilian rocks of this area are differentiated into the Wabaunsee, Shawnee and Douglas groups. These groups are characterized by an alternation in vertical succession of shales and limestones.

Missourian strata consist predominantly of coarsely crystalline limestone. Lithologically, the complete section of the Missourian series is identical, making differentiation into groups very difficult.

There is no evidence supporting an unconformity between the Missourian and Des Moinesian series.

The Cherokee rocks change from a gray micaceous shale in the south to limy shales and limestones in the north along the Kansas border.

Atokan-Morrowan strata are composed chiefly of black carbonaceous shales, undergoing a facies change in a northward direction where some of the shale is replaced by limestone. In many locations a lenticular sand bed is found at the base of the Atoka-Morrowan.

Chesterian strata are the uppermost Mississippian of the area and consists of coarsely crystalline limestones interbedded with shale units and thickening perceptibly to the southeast. Undifferentiated Atokan-Morrowan sediments are found resting unconformably on Chesterian strata.

Coarsely crystalline, cherty fossiliferous limestones comprising the Meramecian strata of this area lie unconformably below the Chesterian and overlie the Osagian series.

The complete section of the Osagian series of Beaver County is made up of rocks of a basinward facies.

The Kinderhookian strata are represented by limestone and dolomite units intercalcated with thin gray shales. A regional truncating unconformity exists at the base of the Kinderhookian series.

Throughout Beaver County the Viola limestone is found unconformably below the Kinderhookian series. Limestones, and dolomitic limestones comprise the Viola section in this area.

The Simpson group is relatively thin and consists of standstone units interbedded with dolomite and shale beds.

The Arbuckle group of this area consists of finely crystalline dolomite near the top of the section grading into a more coarsely crystalline dolomite as the section is penetrated deeper.

Surface anticlinal and synclinal structures are present in the area, but are believed to be superficial in nature, existing only in the Permian strata. The structures are possibly caused by erratic deposition and unconformities which are characteristic of upper Permian deposition. Differential settling could have resulted from soluble rocks being brought into solution and allowing the overlying strata to collapse.

The strata on the north flank of the Anadarko basin dip gently away from the central Kansas uplift and the Sierra Grande-Las Animas arch at an angle usually less than one degree. The north flank of the basin does not seem to have been greatly affected by diastrophic movements.

The embayment is characterized by a deeper area to the southwest which is considered the trough of the Hugoton embayment.

Fossils are relatively abundant in this area, and have assisted in determining the ages of particular horizons.

The samples of the producing formation from the Flynn Oil Company School Land 1, 35-5n-23ecm, appear practically identical with samples of the Marmaton reef in the Novinger pool, northeast of Liberal, Kansas, some 30 miles northwest of Beaver City. There is a possibility that the Flynn well is producing from a similar Marmaton reef.

Ideal reef-building conditions prevail where the deeper portion of the Anadarko basin changes abruptly to a structural platform along the southern boundary of Beaver County. This condition has existed since early Pennsylvanian time.

Beaver County offers both structural traps and sedimentary wedges in Pennsylvanian and Mississippian rocks.

Increase in Activity Sends Exploratory Completions Up

By **CECIL W. SMITH,** WORLD OIL Staff

EXPLORATORY DRILLING rates were stepped up slightly during April and the result was a few more completed wells than were credited to the previous month. The month's completed wells were also slightly more numerous than were recorded in April of last year, and as a result the year's drilling record maintained a lead of 7 percent over last year's record-breaking activity.

A total of 888 exploratory ventures were completed during April, against 870 in March, and 875 in April of 1952. Of those tests, 172 were completed as commercial producers of oil or gas and they amounted to 19.4 percent of the total drilled. That score was slightly higher than the 19.2 percent average for the year's first four months.

After April's tests were counted, the year's total was boosted to 3601 completed exploratory wells, and that amounted to an increase of 7 percent over the 3365 recorded as complete during the same period of record-breaking 1952. However, the current campaign is yielding a little ground to its predecessor in the race for the industry's most active. A month earlier, the lead this year held amounted to 9 percent, while a month before that, it had totaled 13 percent. Despite this slackening, it still appears that 1953 will become the most active exploration year in history.

The month's work resulted in discovery of 112 new oil pools in the U. S. Those were 78 new oil fields and 34 new oil pay horizons in older fields. The results so far this year have been 453 new oil pools, 325 fields and 128 new pays.

Summary of Results of Exploratory Drilling

ITEM	April, 1953	Mar., 1953	FOUR MONTHS January-April 1953	1952	Percent Diff.
Oil Discoveries	112	108	453	437	+ 3.7
New Fields	78	70	325	315	+ 3.2
New Pays	34	38	128	122	+ 4.9
Distillate Discoveries	15	10	47	37	+ 27.0
New Fields	12	6	34	34	.....
New Pays	3	4	13	3	+333.3
Gas Discoveries	20	20	83	69	+ 20.3
New Fields	13	17	67	55	+ 21.8
New Pays	7	3	16	14	+ 14.3
Total Discoveries	147	138	583	543	+ 7.4
Extensions to Fields	25	24	109	119	— 8.4
Oil Fields	19	19	90	98	— 8.2
Distillate Fields	2	3	6	4	+ 50.0
Gas Fields	4	2	13	17	— 23.5
Total Prod. Tests	172	162	692	662	+ 4.5
Dry Holes	716	708	2,909	2,703	+ 7.6
Wildcats	695	694	2,852	2,562	+ 11.3
New Pays	.....	.....	.....	9	—100.0
Outposts	21	14	57	132	— 56.8
Total Expl'tory Tests	888	870	3,601	3,365	+ 7.0
Percent Productive	19.4	18.6	19.2	19.7	.....
Percent Dry	80.6	81.4	80.8	80.3	.....

Results of Exploratory Drilling in April and First 4 Months, 1953-1952, by Districts

State or District	MONTH OF APRIL, 1953													FIRST FOUR MONTHS, 1953																
	Productive Tests									Total Productive	Unproductive Tests			Total Exploratory Tests	Productive Tests							Total Productive		Unproductive Tests			Total Dry		Total Exploratory Tests	
	New Fields			New Pays			Extensions								New Fields			New Pays			Extensions									
	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas		Wildcats	New Pays	Outposts		Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas	4 Mo. 1953	4 Mo. 1952	Wildcats	New Pays	Outposts	4 Mo. 1953	4 Mo. 1952	4 Mo. 1953	4 Mo. 1952
Alabama											2			2											1	18			18	8	18	9
Arizona																										3			3		3	
Arkansas											2			2	4			6						10	10	33			33	21	43	31
California	3		1	3			1		1	9	35		4	48	8		1	8		3	7		1	28	34	133		16	149	123	177	157
Colorado	1		1			1				3	17			20	5		5			1				11	10	88			88	46	99	56
Florida											2			2												11			11	1	11	1
Georgia											2			2												3			3		3	
Idaho																										1			1		1	
Illinois				3			1			4	22			26	3			7			8			18	29	117			117	129	135	158
Indiana	2						1			3	30			33	8		1				2			11	9	102			102	113	113	122
Kansas	12		2	1						15	80			95	51		9	2						62	38	291			291	255	353	293
Kentucky	1						1			2	4			6	9		1				1			11	9	28			28	32	39	41
Louisiana	2	1		1	2			1		7	22			29	8	4		11	5		4	2	1	35	34	116		2	118	104	153	138
North Louisiana					1					1	6			7				1	1		2			4	16	50		1	51	52	55	68
South Louisiana	2	1		1	1			1		6	16			22	8	4		10	4		2	2	1	31	18	66		1	67	52	98	70
Michigan	1		1							2	12			14	5		2				1			8	14	65			65	81	73	95
Mississippi			1					1		2	21			23	3	1	2	3			1	1		11	11	63		1	64	54	75	65
Missouri											1			1												3			3	5	3	5
Montana											6			6	2		1							3	2	25			25	16	28	18
Nebraska	2						1			3	18			21	6						1			7	7	50			50	34	57	41
Nevada											4			4												5			5		5	
New Mexico	2									2	8			10	6		4	1			4			15	23	47			47	40	62	63
North Dakota											3			3											4	15			15	3	15	7
Ohio									1	1	1			2							1		1	2	4	9			9	11	11	15
Oklahoma	8	1	3	3		1	2			18	57			75	31	3	9	14		1	16		1	75	58	232			232	230	307	288
Pennsylvania																							1	1						2	1	2
South Dakota																										2			2	1	2	1
Texas	41	10	4	23	1	5	12		2	98	338		17	453	169	26	31	76	8	11	44	3	8	376	356	1346		38	1384	1343	1760	1699
Dist. 1 S. Central	1				1		1			3	27			30	5	1	1	1	1		1			10	10	99		3	102	104	112	114
Dist. 2 Middle Gulf	1	2	2	2		1				8	28		1	37	7	4	2	4		1				18	38	97		2	99	97	117	135
Dist. 3 Upper Gulf	2	1		7		2	1		1	14	28		10	52	11	5	1	18	5	5	5	2	5	57	49	111		24	135	103	192	152
Dist. 4 L. Gulf-S.W.	6	3	2	7		2			1	21	30			51	15	10	15	19	2	5	1	1	3	71	36	149		3	152	149	223	185
Dist. 5 E. Central	1									1	10			11	2			1	1					4	3	45			45	36	49	39
Dist. 6 Northeast		2								2	13			15	2	2		3						7	14	49			49	44	56	58
Dist. 7-B N. Cent.	10			3			5			18	81		1	100	52		8	12			12			84	68	315		1	316	282	400	350
Dist. 7-C W. Cent.	7	2		1			2			12	33			45	19	4	1	6			4			34	33	118			118	133	152	166
Dist. 8 West	8						3			11	25		1	37	27		1	1			16			45	44	102		1	103	128	148	172
Dist. 9 North	4			3						7	63		4	74	28		1	11			4			44	60	261		4	265	250	309	310
Dist. 10 Panhandle	1									1				1	1						1			2	1					17	2	18
Utah											2			2	2		1							3		17			17	15	20	15
West Virginia																									1				1		1	2
Wyoming	3									3	6			9	5									5	8	29			29	35	34	43
Total U. S.	78	12	13	34	3	7	19	2	4	172	695		21	888	325	34	67	128	13	16	90	6	13	692	662	2852		57	2909	2703	3601	3365

U. S. Discoveries in April

CALIFORNIA—NEW OIL FIELDS

Kern County. Tide Water Associated Oil Co.'s Farnsworth 14-17, SW NW 17-25s-20e, pumped 31 barrels from 2728-68 feet, 27.5-gravity, completed 4-1-53, TD 2769.

Los Angeles County, Del Rey-East field. Donald Frankel, Operator's Kidson 1-1, in 22-2s-15w, Old Well Worked Over, flowed 67 barrels from 7404-19 feet, 15/64-inch, 24.9-gravity, completed 4-11-53, TD 7474.

Orange County, "Olive" field. The Texas Co.'s Dinkler 1, NE NE 7-4s-9w, pumped 94 barrels from Pliocene sand 5590-5741 feet, 16.9-gravity, completed 4-19-53, TD 7392.

CALIFORNIA—NEW OIL PAYS

Kern County, Mountain View field. M. J. M. & M. Oil Co.'s Atlantic-Wible 3, in 23-30s-28e, Old Well Drilled Deeper, flowed 488 barrels from Nozu sand 7301-53 feet, 20/64-inch, 36.5-gravity, completed 4-3-53, TD 7354.

Rosedale Ranch field. Standard Oil Co.'s "KCL 31" 14-1, in 1-29s-26e, flowed 212 barrels from 4168-4348 feet, 17.6-gravity, completed 4-8-53, TD 4350.

Los Angeles County, Del Amo field. The Texas Co.'s Del Amo 1, NE SW 2-4s-13w, flowed 243 barrels from 8611-46 feet, 16/64-inch, 30.4-gravity, completed 4-20-53, TD 8724.

CALIFORNIA—OIL FIELD EXTENSION

Santa Barbara County, Jesus Maria field. Union Oil Co.'s Jesus Maria 46-3, in 3-8n-35w, pumped 115 barrels from 3236-3665 feet, 15.2-gravity, completed 4-20-53, TD 3760.

CALIFORNIA—NEW GAS FIELD

Madera County. Harry H. Magee's Stone 1-7, in 7-12s-15e, flowed 3 million from Nortonville sand 3902-10 feet, ½-inch, completed 4-10-53, TD 3965.

CALIFORNIA—GAS FIELD

Tehama County, Corning field. Superior Oil Co.'s Smith-Russell 1, in 13-24n-3w, ⅜-mile south extension, flowed 2.1 million from 1529-44 feet, 24/64-inch, completed 4-6-53, TD 1650.

COLORADO—NEW OIL FIELD

Morgan County. Roden, Darden & McRae's Olson 1, C SW NE 23-1n-55w, flowed 608 barrels from Dakota "J" sand, Upper Cretaceous 4906-13 feet, ½-inch, completed 4-23-53, TD 4916.

COLORADO—NEW GAS FIELD

Mesa County. Frontier Refining Co.'s Government 1, C NW NW 31-8s-104w, flowed 8.5 million from Dakota sand, Upper Cretaceous 2838-80 feet, ¾-inch, completed 4-5-53, TD 3550.

COLORADO—NEW GAS PAY

Moffat County, Powder Wash field. Mountain Fuel Supply Co.'s Carl Allen 6, SE SW SE 33-12n-97w, flowed 8.8 million from Mesaverde sand 8085-8123 feet, completed 3-14-53, TD 8406.

ILLINOIS—NEW OIL PAYS

Lawrence County, Lawrence, West field. Big Four Oil & Gas Co.'s E. Staats 1, SW NW SW 13-3n-13w, ½-mile north of production, pumped 160 barrels from Aux Vases sand, Mississippian 2107-15 feet, completed 4-14-53, TD 2229.

Lawrence, West field. N. V. Duncan's Pepple 1, NW SW SW 13-3n-13w, pumped 90 barrels from McClosky lime, Mississippian 2221-35 feet, completed 4-14-53, TD 2235.

Wayne County, Merriam field. Cullum & Lawhead's Hoffee 1, NW SW NE 3-2s-8e, Old Well Worked Over, pumped 45 barrels oil and 45 barrels water from Aux Vases sand, Mississippian 3021-33 feet, completed 4-7-53, TD 3390.

ILLINOIS—OIL FIELD EXTENSION

Clay County, Clay City Consolidated field. Nation Oil's H. Blair 1, SW NE SW 17-3n-8e, Old Well Worked Over, ½-mile extension, pumped 15 barrels oil and 20 barrels water from Aux Vases sand, Mississippian 2926-37 feet, completed 4-7-53, TD 3080.

INDIANA—NEW OIL FIELDS

Spencer County. John W. Tuttle's Sebastian Lehr 1, NE NE NE 16-7s-6w, pumped 25 barrels oil and 5 barrels water (20-hrs.) from 1452-57 feet, TD 1457.

Unnamed field. Stanoco Oil Co.'s Louis E. Cooper 1, NE NE SE 9-7s-6w, pumped 55 barrels from Tar Springs sand, Mississippian 914-45 feet, TD 1006.

INDIANA—OIL FIELD EXTENSION

Gibson County, Francisco field. H. C. Sanders' James O. Sevedge 1, W½ SW NW 9-2s-9w, pumped 45 barrels from O'Hara lime, Mississippian 1708-12 feet, TD 1813.

KANSAS—NEW OIL FIELDS

Barton County. Pabco Drilling's Thill 1, SW SW NW 28-19s-11w, flowed 318 barrels from Lansing lime, Pennsylvanian 3216-20 feet, TD 3366.

Cowley County, Burden, East field. The Texas Co.'s Jarvis 1, NW SW NW 33-31s-6e, pumped 80 barrels oil and 240 barrels water from Stalnaker sand 1824-40 feet, TD 3065.

Unnamed field. Laura Jane Oil Co.'s Allen 1, SW SW NW 12-33s-3e, pumped 25 barrels from Bartlesville sand, Pennsylvanian 3264-68 feet, TD 3293.

Ellis County, Turkville field. Derby Oil Co.'s McCombs 1, SE SE SW 11-11s-17w, pumped 52 barrels oil and 165 barrels water from Arbuckle lime, Ordovician 3360-64 feet, TD 3364.

Unnamed field. Carl Lebsack's Holy Cross 1, SE SE SE 26-12s-18w, pumped 186 barrels from Lansing lime, Pennsylvanian 3423-45 feet, TD 3630.

Graham County, White, Southwest field. Harry Gore & Stanolind Oil & Gas Co.'s Lewis 1, NW SE NE 35-10s-21w, pumped 729 barrels from Arbuckle lime, Ordovician 3690-95 feet, TD 3695.

Unnamed field. Peel-Hardman Oil Producers' Cooley 1, NE NE SE 7-9s-21w, pumped 386 barrels from Arbuckle lime, Ordovician 3787-90 feet, TD 3790.

Marion County, Durham field. Anderson-Prichard Oil Corp.'s Scully 1-A, SE NW NW 34-18s-2e, pumped 202 barrels from Viola lime, Ordovician 2900-01 feet, TD 2901.

McPherson County, Lively field. National Associated Petroleum Corp.'s Lively 1, NE SE NE 28-17s-2w, flowed 273 barrels from Mississippi lime, Mississippian 2956-63 feet, TD 2961.

Rooks County, Allphin field. Continental Oil Co.'s Allphin 1, SW SW NW 33-10s-20w, pumped 497 barrels from Arbuckle lime, Ordovician 3729-36 feet, 30-gravity, TD 3736.

Stafford County, Shepherd, South field. Ed Adair & Ray Fleming's Sleeper 2, SW SE NW 21-22s-11w, pumped 198 barrels from Arbuckle lime, Ordovician 3602-12 feet, TD 3612.

Summer County. Associated Co. Inc.'s Dyal 1, NE NE NW 4-35s-2e, pumped 50 barrels from Bartlesville sand, Pennsylvanian 3421-32 feet, TD 3497.

KANSAS—NEW OIL PAY

Rooks County, Mt. Ayr field. Champlin Refining Co.'s Garvert 1, SW SW SW 18-10s-17w, pumped 53 barrels from Lansing-Kansas City lime, Pennsylvanian 3648-58 feet, TD 3753.

KANSAS—NEW GAS FIELDS

Barber County, Nurse field. Champlin Refining Co.'s Winter 1, SW SE SE 12-31s-13w, flowed 4.0 million from Douglas sand, Pennsylvanian 3544-53 feet, TD 3620.

Meade County, Kismet, East field. Columbian Fuel Corp.'s Whealy 1, C NW NW 30-33s-30w, flowed 5.5 million from Morrow sand, Mississippian 5645-52 feet, open, TD 6120.

KENTUCKY—NEW OIL FIELD

Muhlenberg County. E. J. Briney & Bill Catron's J. B. Greenwood 1, SE SE NE 17-I-29, pumped 38 barrels from Aux Vases sand, Mississippian 1669-85 feet, TD 1760.

KENTUCKY—OIL FIELD EXTENSION

Henderson County. Ryan Oil Co.'s Gemmell Heirs 1, 10-P-22, ½-mile southwest extension, pumped 58 barrels from Aux Vases lime, Mississippian 2519-37 feet, TD 2654.

NORTH LOUISIANA—NEW DISTILLATE PAY

Lincoln Parish, Clay field. Southwest Gas Producing Co., Inc. & Feazel Interests' Sherrard 1, N½ NW SE 10-17n-3w, flowed 29 barrels distillate and 3.3 million from "D" sand, Jurassic 10,058-072 feet, 20/64-inch, 54-gravity, completed 4-21-53, TD 10,072.

SOUTH LOUISIANA—NEW OIL FIELDS

Plaquemines Parish, Southwest Pass area. The California Co.'s Louisiana State 1924-1, flowed 240 barrels from 8703-16 feet, 9/64-inch, 32.1-gravity, completed 4-10-53, TD 8906.

St. Mary Parish. The Texas Co.'s St. Mary Parish School Board 1, in 16-17s-12e, flowed 138 barrels oil and 17 barrels water from 11,687-696 feet, 8/64-inch, 27-gravity, completed 4-10-53, TD 13,694.

SOUTH LOUISIANA—NEW OIL PAY

St. Landry Parish, Washington field. Sohio Petroleum Co. & Gulf Oil Corp.'s Thistlewaite Lumber Co. 8, in 61-4s-4e, flowed 200 barrels from 7712-17 feet, 9/64-inch, 38.8-gravity, completed 4-29-53, TD 8200.

SOUTH LOUISIANA—NEW DISTILLATE FIELD

Lafourche Parish, Kramer area. Magnolia Petroleum Co.'s Bowie Lumber Co. 1, in 1-14s-17e, Old Well Drilled Deeper, flowed 165 barrels distillate and 3.4 million from 11,576-588 feet, 15/64-inch, 53.3-gravity, completed 4-12-53, TD 12,410.

SOUTH LOUISIANA—NEW DISTILLATE PAY

Assumption Parish, Napoleonville field. Texas Gulf Producing Co.'s Armelise Planting Co. 1, in 44-12s-13e, ¾-mile southeast extension, flowed 50 barrels distillate from 10,450-464 feet, 12/64-inch, 51.0-gravity, completed 4-10-53, TD 11,105.

SOUTH LOUISIANA—DISTILLATE FIELD EXTENSION

St. Landry Parish, Lewisberg field. Atlantic Refining Co.'s Donald S. Gardner 1, in 5-7s-3e, 1-mile north extension, flowed 52 barrels distillate and 3.6 million from Lower Miocene sand, Miocene 9300-05 feet, ¼-inch, 50-gravity, completed 4-7-53, TD 10,995.

MICHIGAN—NEW OIL FIELD

Ottawa County. Allied Investments, Inc.'s Nixon 1, NW SE SE 9-8n-14w, Polkton Township, pumped 40 barrels from Traverse lime, Devonian 1891-95 feet, TD 1895.

MICHIGAN—NEW GAS FIELD

Muskegon County. Taggart Bros. Gas Co.'s Kessler 1, NW SW NW 7-12n-17w, Montague Township, flowed 0.5 million from Niagaran lime, Silurian 3732-3805 feet, TD 3995.

MISSISSIPPI—DISTILLATE FIELD EXTENSION

Wilkinson County, Possum Corner field. Calto Oil Co.'s Crosby Lumber Co.'s 1-A, in 4-4n-2w, ½-mile northeast extension, flowed 4 barrels distillate and 1.5 million from Wilcox sand, Eocene, 10/64-inch, 51-gravity, completed 4-16-53, TD 7010.

MISSISSIPPI—NEW GAS FIELD

Chickasaw County, "Coleville" field. Vaughey & Vaughey's U. S. Government 1, NW SE SW NW 9-12s-4e, flowed 1.1 million from Evans sand, Mississippian 2409-21 feet, ⅜-inch, completed 4-3-53, TD 2740.

NEBRASKA—NEW OIL FIELDS

Cheyenne County. Chicago Corp. & Republic Natural Gas Co.'s Doran Farms Inc.'s 1, NE NE SW 27-14n-50w, pumped 97 barrels from "D" sand, Upper Cretaceous 4596-98 feet, completed 4-8-53, TD 4783.

Unnamed field. James P. Sloss' George Thompson 1, NE NW SE 12-14n-51w, pumped 52 barrels oil and 13 barrels water from "D" sand, Upper Cretaceous 4746-50 feet, 40-gravity, completed 4-15-53, TD 5202.

Unnamed field. Chicago Corp. & Republic Natural Gas Co.'s Krueger-Ladegard 2, SW NE SW 31-14n-50w, ½-mile southwest extension, pumped 39 barrels oil and 5 barrels water from "D" sand, Upper Cretaceous 4759-61 feet, completed 3-16-53, TD 4991.

NEW MEXICO—NEW OIL FIELDS

Chaves County. Republic Natural Gas Co. & Seaboard Oil Co. of Delaware's White Ranch 1, in 34-11s-29e, flowed 294 barrels from Siluro-Devonian sand 8725-75 feet, ¼-inch, 47.1-gravity, completed 4-7-53, TD 8781.

Lea County. Continental Oil Co.'s Anderson Ranch Unit 1, in 11-16s-32e, potentialed 1968 barrels from Devonian lime, Devonian 13,374-400 and 13,408-474 feet, 30/64-inch, 54-gravity, completed 4-6-53, TD 13,775.

OHIO—GAS FIELD EXTENSION

Tuscarawas County, Cambridge field. Blackstone & Ebersbach's John Gooding 1, Lot 10, Clay Township, flowed 0.2 million from Berea sand, Mississippian 860-862 feet, completed 4-20-53, TD 862.

OKLAHOMA—NEW OIL FIELDS

Lincoln County. Foster Drilling Co.'s Josephine 1, SW SW SW 3-15n-5e, flowed 288 barrels from Oswego lime, Pennsylvanian 3283-92 feet, 10/64-inch, 51-gravity, TD 3884.

Logan County, Navina, Southwest field. MacMillian Petroleum Corp. et al's Krout 1, NE NW SW 14-15n-4w, flowed 295 barrels from Second Wilcox sand, Ordovician 6478-88 and 6508-38 feet, 20/64-inch, 42-gravity, TD 7350.

Unnamed field. Jordan Petroleum Co.'s Harbach 1, SW SW SW 19-15n-1e, flowed 241 barrels from Second Wilcox sand, Ordovician 5828-36 feet, 14/64-inch, TD 5845.

Oklahoma Countv. Robert M. Jordan's Rogers 1, NE NE NE 18-14n-1e, flowed 103 barrels from Cleveland sand, Pennsylvanian 4412-26 feet, 14/64-inch, 41-gravity, TD 5903.

Pawnee County. H. J. Schafer et al's Boyd Meeker 1, SE SE SE 33-21n-5e, pumped 13 barrels oil and 18 barrels water from Prue sand, Pennsylvanian 3109-18 and 3124-42 feet, TD 3316.

Unnamed field. H. Waggoner & Co.'s Skeen 1, NW NW SE 30-20n-6e, flowed 30 barrels from Skinner sand, Pennsylvanian 3080-98 feet, TD 3230.

Pottawatomie County. K. A. Ellison's Niehaus 1, NE SE SE 21-7n-3e, pumped 142 barrels oil and 120 barrels water from Viola Trenton lime. Ordovician 4817-27 feet, 37-gravity, TD 4999.

Stephens County. Schermerhorn Oil Corp.'s Ryan 1, SE SW NW 24-1n-4w, pumped 34 barrels from Tussy sand, Pennsylvanian 4934-44 feet, 22-gravity, TD 5466.

OKLAHOMA—NEW OIL PAYS

Caddo County. Continental & Superior's L. V. Smith 1, C SE NW 32-10n-12w, pumped 30 barrels from Hoxbar lime, Pennsylvanian 9196-9240 and 9550-95 feet, TD 13,545.

Kay County, Unnamed field. H. Waggoner & Co.'s Buesing 2, NW SE SE 32-27n-1e, flowed 360 barrels from 1st Wilcox sand, Ordovician 3723-36 feet, 10/64-inch, TD 3736.

McClain County, Freeny, North field. Jay Simmons' Ray Wilson 1, SE SE SE 14-8n-4w, flowed 411 barrels from Tulip Creek sand, Ordovician 10,447-471 and 10,482-488 feet, 49-gravity, TD 11,212.

OKLAHOMA—OIL FIELD EXTENSIONS

Logan County, Crescent, East field. E. Julian Davis et al's Coffin 1, SE SE NW 10-17n-3w, north extension, flowed 130 barrels from Lower 1st Wilcox sand, Ordovician 6126-30 feet, 11/64-inch, TD 6228.

Osage County, St. John, West field. M. R. Ramsey's Osage 1, NE NE NW 1-24n-6e, west extension, flowed 100 barrels oil and 21 barrels water from Burbank sand, Pennsylvanian 2693-2705 feet, ⅜-inch, TD 2705.

OKLAHOMA—NEW DISTILLATE FIELD

Logan County. General Production Co.'s Schaefer 1, NE SW SE 28-15n-2w, flowed 15 barrels distillate and 3.8 million from Bartlesville sand, Pennsylvanian 5834-48 feet, 7/64-inch, TD 6351.

OKLAHOMA—NEW GAS FIELDS

Cimarron County. Cities Service Oil Co.'s Whisennand 1, C NE NE SW 2-5n-9ecm, flowed 6.4 million from Keys sand, Mississippian 4604-28 feet, TD 4872.

Garfield County. Panda Drilling Co.'s Nelson Moore 1, NE NW NE 26-22n-3w, flowed 8.2 million from Hoy sand 1448-51 feet, TD 1451.

Stephens County. Wm. H. Atkinson's Federal Land Bank 1, NW NW NW 15-3s-6w, Old Well Worked Over, flowed 10.0 million from 730-734 feet, TD 2523.

OKLAHOMA—NEW GAS PAY

Garvin County, Civet, Southeast field. Davon Oil & Gas Co.'s Shumate 1, NE NE SE 10-3n-2e, flowed 2.0 million from Tonkawa sand, Pennsylvanian 1970-71 feet, TD 2908.

TEXAS DISTRICT 1—NEW OIL FIELD

Bexar County. Milton M. Cooke's Michael Chuturich 1, Jacinto Pena Survey No. 9, pumped 12 barrels from Navarro sand, Upper Cretaceous 622-1252 feet, 38-gravity, completed 3-12-53, TD 1252.

TEXAS DISTRICT 1—OIL FIELD EXTENSION

Frio County, Pearsall-Austin Chalk field. F. William Carr's Cory & McWilliams 1, S. Maverick & Jose Arocha Survey No. 299, Block 14, flowed 85 barrels from Austin Chalk, Upper Cretaceous 5405-5895 feet, 12/64-inch, 27.8-gravity, completed 3-27-53, TD 5895.

TEXAS DISTRICT 1—NEW DISTILLATE PAY

Atascosa County, Jourdanton field. American Republics Corp.'s Florence C. Wilson 1, John Gaston Survey, flowed 135 barrels distillate and 8.0 million from Edwards lime, Lower Cretaceous 7455-7523 feet, open, completed 4-21-53, TD 7527.

TEXAS DISTRICT 2—NEW OIL FIELD

Refugio County, Fulton Beach area. C. G. Glasscock & Humble Oil & Refining Co.'s State of Texas Tract 8-1, Copano Bay, flowed 119 barrels from 6855-57

feet, 7/64-inch, 43-gravity, completed 4-13-53, TD 7520.

TEXAS DISTRICT 2—NEW OIL PAYS

De Witt County, Sally field. J. R. Butler et al's H. Riedel 1, Jose Santos Survey, pumped 18 barrels oil and 240 barrels water from 4522-4525 feet, 45-gravity, completed 4-8-53, TD 4621.

Victoria County, Battle field. Houston Oil Co. of Texas' Gottlieb Gutman 3, P. Gallardo Survey, flowed 37 barrels oil and 22 barrels water from 4847-55 feet, 20/64-inch, 27-gravity, completed 4-17-53, TD 5220.

TEXAS DISTRICT 2—NEW DISTILLATE FIELDS

Calhoun County. The Chicago Corp.'s Mrs. John Stofer 1, William Lewis Survey, flowed 220 barrels distillate and 5.5 million from 7443-59 feet, open, 62.8-gravity, completed 4-1-53, TD 9182.

Live Oak County, Peeler field. F. William Carr's George W. West Estate 1, W. D. Hodges Survey No. 230, flowed 120 barrels distillate and 9.0 million from Wilcox sand, Eocene 7348-58 feet, open, 59.1-gravity and flowed 160 barrels distillate and 8.0 million from Wilcox sand, Eocene 7925-40 feet, open, 59.5-gravity, completed 4-10-53, TD 8558.

TEXAS DISTRICT 2—NEW GAS FIELDS

Jackson County. D. M. Wallace's P. K. Miller "A" 1, Juan Fernandez Survey, flowed 28.0 million from Frio sand, Oligocene 5469-73 feet, completed 4-18-53, TD 6070.

Unnamed field. Maxima Oil Co.'s M. G. Johnson 1, flowed 25 million from 3612-17 feet, open, completed 4-13-53, TD 4780.

TEXAS DISTRICT 2—NEW GAS PAY

Bee County, Caesar field. Siznod Oil Corp.'s R. E. Miller Estate 1, Franklin Lewis Survey, flowed 190 million from Hockley sand, Eocene 2280-94 feet, completed 4-15-53, TD 2302.

TEXAS DISTRICT 3—NEW OIL FIELDS

Fayette County. Sutton Drilling Co.'s E. A. Arnim B-2, Wm. Kuykendall ⅓ League Grant, pumped 61 barrels from Steinhouser sand, Eocene 2231-36 feet, 23.0-gravity, completed 4-8-53, TD 2236.

Wharton County, "Duke" field. Texas State Drilling Co.'s G. W. Hall 1, J. B. Morford Survey, Section 12, flowed 118 barrels from Frio sand, Oligocene 6276-82 feet, 7/64-inch, 41-gravity, completed 4-29-53, TD 6520.

TEXAS DISTRICT 3—NEW OIL PAYS

Fayette County, Flatonia, West field. Hamman Oil & Refining Co. & States Marine Corp.'s E. A. Arnim et al "B" 1-B, William Kuykendall ⅓ League, pumped 25 barrels from Arnim "A" sand, Eocene 2050-59 feet, 21-gravity, completed 4-1-53, TD 2059.

Fort Bend County, Thompsons field. Gulf Oil Corp.'s M. Gubbels, et al A-7, Samuel Kennedy Survey, Old Well Drilled Deeper, flowed 300 barrels from Vicksburg sand, Oligocene 7534-49 feet, ⅛-inch, 36.9-gravity, completed 4-30-53, TD 7600.

Hardin County, Hampton, South-West Flank field. American Republics Corp. & Houston Oil Co.'s Henry Binns Fee 10, Henry Binns League, flowed 38 barrels from Yegua (F-2) sand, Eocene 7818-22 feet, 7/64-inch, 39.1-gravity, completed 4-11-53, TD 8484.

Jefferson County, Big Hill field. Adams & Haggarty's Marrs McLean 3-D, ELRR Co. Survey 373, flowed 172 barrels from Discorbis sand, Eocene 6228-41 feet, 9/64-inch, 31.5-gravity, completed 4-7-53, TD 6338.

Spindletop field. Michel T. Halbouty's Marrs McLean Fee 2, P. Humphries Survey, Old Well Worked Over, flowed 115 barrels from Miocene sand, Miocene 3155-61 feet, 8/64-inch, 25-gravity, completed 4-26-53, TD 4873.

Liberty County, North Dayton field. John W. Mecom's Roy Seaburg 3-A, H&TC RR Survey 120, ½-mile southwest of production, flowed 186 barrels from Basal Miocene sand, Miocene 3714-38 feet, 10/64-inch, 24.3-gravity, completed 4-6-53, TD 4514.

Montgomery County, Bender field. Sinclair Oil & Gas Co.'s Bender Estate 1, Montgomery County School Land Survey, flowed 175 barrels from Yegua (Y-5) sand, Eocene 6076-78 feet, 10/64-inch, 35.3-gravity, completed 4-18-53, TD 6453.

TEXAS DISTRICT 3—OIL FIELD EXTENSION

Brazoria County, Lochridge Dome field. C. M. & V. W. & P. M. Frost's Fee 1, Andrew Robinson Survey, flowed 149 barrels from Frio sand, Oligocene 6324-26 feet, 12/64-inch, 26-gravity, completed 4-26-53, TD 6332.

TEXAS DISTRICT 3—NEW DISTILLATE FIELD

Liberty County. General Crude Oil Co.'s Mrs. Elizabeth Morris et al 2, Peter Mason Survey, flowed 640 barrels distillate and 45.0 million from Cook Mountain sand, Eocene 11,247-249 feet, open, 55-gravity, completed 4-7-53, TD 11,825.

TEXAS DISTRICT 3—NEW GAS PAYS

Harris County, E. Satsuma field. Amerada Petroleum Corp.'s Nellie Watkins Unit 1, WCRR Co. Survey, ½-mile southwest of production, flowed 5.0 million from 2nd Fairbanks sand, Oligocene 6814-18 feet, open, completed 4-17-53, TD 7722.

Wharton County, Trans-Tex field. Warren Petroleum Corp.'s Guy Stovall 1, P. B. Norton Survey, flowed 1.1 million from 3026-29 feet, 13/64-inch, completed 4-12-53, TD 5125.

TEXAS DISTRICT 3—GAS FIELD EXTENSION

Matagorda County, Unnamed field. Brazos Oil & Gas Co.'s J. P. Wilkinson et al 1, Benjamin Wrightman Survey, Lot 6, ½-mile west extension, flowed 24.0 million from 3268-70 and 3255-68 feet, open, completed 4-11-53, TD 6250.

TEXAS DISTRICT 4—NEW OIL FIELDS

Brooks County, Mills Bennett field. Mills Bennett Estate's Fee-Mills Bennett Estate 1, Juan Guerra "EL Tule Grant," flowed 121 barrels from Frio sand, Oligocene 4675-87 feet, 8/64-inch, 45.3-gravity, completed 4-11-53, TD 6099.

Jim Hogg County, Silver Lakes field. Southern Minerals Corp.'s Silver Lake Ranches, Inc. 1-A, Fowler & Rankin Subdivision "EL Sordo" Luis Vela Grant, Block 10, flowed 73 barrels from Pettus sand, Eocene 4125-31 feet, 10/64-inch, 44-gravity, completed 4-23-53, TD 4160.

Nueces County, Ransom Island field. Phillips Petroleum Co.'s "Fish" A-324 Redfish Bay A-1, State Submerged Lands, Redfish Bay State Tract 324, flowed 174 barrels from 7664-66 feet, ⅛-inch, 39.0-gravity, completed 4-21-53, TD 8799.

Unnamed field. Appell Drilling Co.'s C. A. Potts 1, George H. Paul Subdivision "D," Tract 3, flowed 121 barrels from 5815-19 feet, ⅛-inch, 41.0-gravity, completed 4-12-53, TD 5827.

Webb County, St. Joseph field. Wymore Oil Corp.'s J. C. Martin Trustee 1, M. T. Tippan Survey 2345, pumped 97 barrels from O'Hern sand, Eocene 3085-97 feet, 34.0-gravity, completed 3-31-53, TD 3097.

Zapata County, El Ranchito field. The Texas Co.'s J. C. Martin NCT 1-2, Jose Basquez Borrego Grant, O. W. Killam Subdivision, pumped 10 barrels from Upper Jackson sand, Eocene 890-900 feet, 28.3-gravity, completed 3-28-53, TD 1753.

TEXAS DISTRICT 4—NEW OIL PAYS

Aransas County, Fulton Beach, East field. T. E. Murchinson et al's Nan Holden et al 1, Fulton Townsite, Block 93, flowed 196 barrels from "B-2" sand, Oligocene 7152-58 feet, 10/64-inch, 41.4-gravity, completed 4-2-53, TD 7290.

Hidalgo County, Tabasco field. George H. Coates, Salomon Chapa 3, Porcion 74, flowed 133 barrels from "F" (Heard) sand, Oligocene 5038-48 feet, 8/64-inch, 45.1-gravity, completed 4-16-53, TD 6000.

Nueces County, Clarkwood, South field. W. M. Bevly's A. G. Becker Tr.-W. I. Pulliam 1, J. H. Gallagher Survey 318, flowed 173 barrels from 7142-44 feet, 9/64-inch, 42.0-gravity, completed 4-11-53, TD 7146.

East White Point field. Sinclair's State Nueces Bay Tract 688-16, flowed 126 barrels from Frio sand, Oligocene 5874-78 feet, 5/32-inch, 32.3-gravity, completed 4-12-53, TD 6000.

San Patricio County, Ewing field. The Chicago Corp.'s A. L. Sims 1, George H. Pauls Subdivision, Coleman Fulton Pasture Lands, Lot 8, Block E, flowed 141 barrels from Simms sand, Oligocene 5892-5900 feet, ⅛-inch, 37.0-gravity, completed 4-30-53, TD 6865.

Starr County, El Benadito field. Magnolia Petroleum Co.'s W. T. Neblett 3, Subdivision E, El Benadito Grant, Share 4, flowed 129 barrels from 5725-27 feet, 8/64-inch, 43.8-gravity, completed 4-15-53, TD 6000.

Sun, North field. Kirkpatrick-Coates & Vessels' Quirano Vela 1, Santa Teresa Grant, flowed 13 barrels from 5812-26 feet, 7/64-inch, 43.6-gravity, completed 4-11-53, TD 5973.

TEXAS DISTRICT 4—NEW DISTILLATE FIELDS

Hidalgo County, Monte Christo field. The Superior Oil Co.'s F. I. Johnson et al 1, E. B. Pue Survey 206, flowed 30 barrels distillate and 26.5 million from 6340-50 feet, open, 55.3-gravity, completed 4-12-53, TD 11,051.

Nueces County. Austral Oil Exploration Co. Inc.'s State Tract 20-1, Corpus Christi Bay Tract 20, flowed 60 barrels distillate and 1.5 million from 8603-11 feet, 8/64-inch, 52-gravity, completed 4-26-53, TD 8772.

San Patricio County. Sun Oil Co.'s M. A. Broughton 1-A, C. C. Hornsby Survey, flowed 445 barrels distillate and 13.0

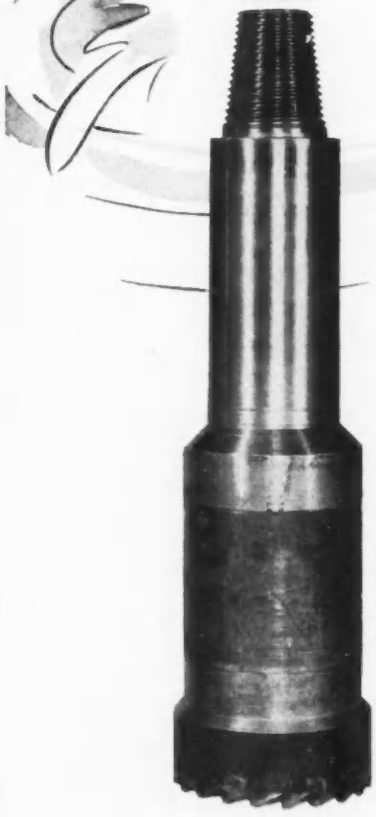
..when You're Fishing with K & G!

When you've got *fish* in the hole, causing costly delay, do like so many major oil companies and drilling contractors do . . . call for K & G . . . the practical junk remover.

The K & G Magnetic Fishing Tool, the first successful magnetic fishing tool, was pioneered by K & G . . . it's been proved, by 90% recoveries on over 1000 jobs during the past year, to be the most practical fishing tool yet developed for removing junk from the hole.

Ruggedly built to take it in the field, the powerful K & G is available in various sizes, with various styles of rotary shoes, and can be run on tubing, drill pipe and from wire line in cases where hole is clean and free from cuttings.

The powerful magnetic field—controlled and localized at the pole plate—quickly and efficiently picks up hard-to-recover metallic junk . . . chipped teeth, lost cones, bearings, sledge hammers . . . saving hours of lost rig time and expensive bits.



The K & G Magnetic Fishing Tools, with operators, are available in sizes 1¾", 3¼", 4", 5", 6", 7", 8", 9" and 11½", on rental basis, from stores indicated below. Phone, write or wire for quotations on use in your area.

BE SURE TO SEE THAT IT'S K & G

K & G **DESIGNED, DEVELOPED AND MANUFACTURED IN THE U.S.A.**

3050

OIL TOOL AND SERVICE COMPANY, Inc.

2703 Sackett Street Houston 6, Texas JAckson 5436

BRANCH OFFICES—TEXAS: Corpus Christi, Ph. 4-4191; Odessa, Ph. 7-2172 • NEW MEXICO: Farmington, Ph. 199W; Hobbs, Ph. 3-5546 • OKLAHOMA: Oklahoma City, Ph. ME-8-0359, Velma, Ph. 91K52 • CALIFORNIA: Long Beach, Oil Well Drain Hole Co., Ph. 40-8577 • LOUISIANA: New Iberia, Ph. 2-8175 • WYOMING: Casper, Ph. 3-5749 • MISSISSIPPI: Brook Haven, Ph. 2148

million from 9034-39 feet, open, 53.4-gravity, completed 4-30-53, TD 9600.

TEXAS DISTRICT 4—NEW GAS FIELDS

Cameron County. Texas Gulf Producing Co.'s J. A. Garcia et al 1, "Potrero de Santa Isabel" Rafael Garcia Grant, flowed 4.2 million from Miocene sand 7315-25 feet, open, completed 4-2-53, TD 10,537.

Willacy County, Tenerias field. Humble's Sauz Ranch-Tenerias "T" A/C No. 1 T-3, San Juan de Carricitos Grant, Share 64, flowed 162 barrels distillate and 16.5 million from Marginulina sand, Oligocene 7850-7900 feet, open, 44.1-gravity, completed 4-8-53, TD 9000.

TEXAS DISTRICT 4—NEW GAS PAYS

Nueces County, Unnamed field. Arnold O. Morgan & Pratt-Hewitt Oil Corp.'s J. S. Cabron 1, George H. Paul Subdivision "D," Driscoll Ranch Tract 4, ungauged from 5022-28 feet, completed 4-14-53, TD 5855.

TEXAS DISTRICT 4—GAS FIELD EXTENSION

Kenedy County, Unnamed field. Sun Oil Co.'s Laguna State 229-1, Subdivision of Laguna Madre State Tract 229, ⅔-mile southwest extension, flowed 2.4 million from 7240-50 and 7260-70 feet, completed 4-6-53, TD 7347.

TEXAS DISTRICT 5—NEW OIL FIELD

Kaufman County. R. S. Peveto & Cooper Herring's C. P. Williams 1, in G. Y'Barbo Survey, flowed 96 barrels from Woodbine sand, Upper Cretaceous 3258-63 feet, 12/64-inch, 34.2-gravity, completed 4-2-53, TD 3270.

TEXAS DISTRICT 6—NEW DISTILLATE FIELDS

Harrison County. Arkansas Louisiana Gas Co.'s Anita Bookout 1, in R. Ferguson Survey, flowed distillate and 1.5 million from Travis Peak sand, Lower Cretaceous 6220-25 and 6227-29 feet, ¼-inch, completed 4-13-53, TD 6621.

Unnamed field. La Gloria Corp.'s Frank Thomas 1, J. D. Campbell Survey, flowed 71 barrels distillate and 4.4 million from Lower Pettit lime, Lower Cretaceous 6401-90 feet, ⅜-inch, 60.19-gravity, completed 4-15-53, TD 6775.

TEXAS DISTRICT 7-C—NEW OIL FIELDS

Coke County. Humble's Mrs. Helen Harris Weaver 1, Section 7, EL&RR Survey, pumped 104 barrels oil and 113 barrels water from Palo Pinto lime, Pennsylvanian 5336-52 feet, 2½-inch, 42.4-gravity, completed 4-7-53, TD 6989.

Runnels County, Norton area. Mar-Tex Oil & Gas Corp.'s Homer C. Daniel 1, J. A. Yeary Survey 273, flowed 221 barrels from Cross Cut sand, Pennsylvanian 4276-88 feet, 20/64-inch, 42-gravity, completed 4-2-53, TD 4323.

Unnamed field. T. W. Murray et al's H. F. Lindemann 1, D. Diaz Survey 532, flowed 61 barrels from McMillan sand, Pennsylvanian 2535-37 feet, ½-inch, 43.1-gravity, completed 4-9-53, TD 2537.

Schleicher County, Toenail Ranch field. R. W. Berry et al's A. B. Thomerson 1, Section 65, Block H, GH&SA Survey, flowed 135 barrels from Strawn Reef lime, Pennsylvanian 5288-97 feet, 3/16-inch, 39.2-gravity, completed 3-31-53, TD 5754.

Tom Green County, Susan Peak area. La Gloria Corp. & H. Bryan Poff's Mona Green Kent 1, Section 152, Block 11, SPRR Survey, flowed 44 barrels from Canyon sand, Pennsylvanian 4265-67 feet, 12/64-inch, 40.2-gravity, completed 4-11-53, TD 4755.

TEXAS DISTRICT 7-C—NEW OIL PAY

Coke County, Bronte, North field. Lion Oil Co.'s Mary 5, Section 390, Block 1-A, H&TC Survey, flowed 178 barrels from Canyon sand, Pennsylvanian 4184-93 feet, 14/64-inch, 46-gravity, completed 4-23-53, TD 5616.

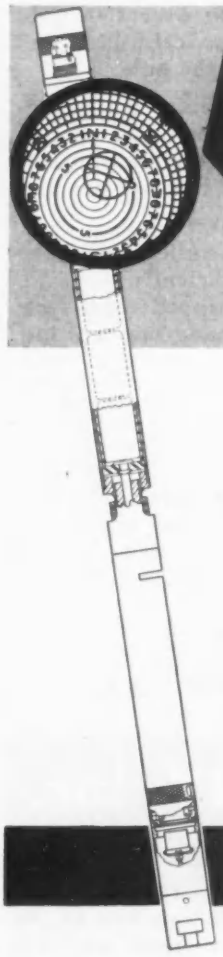
TEXAS DISTRICT 7-C—OIL FIELD EXTENSIONS

Crockett County, Midway Lane field. Tubb & Gann Drilling Co.'s Chambers CSL 1, League 4, Chambers County School Land Survey, ½-mile southeast extension, pumped 67 barrels from Queen sand, Permian 1286-92 feet, 34-gravity, completed 4-21-53, TD 1292.

TEXAS DISTRICT 7-C—NEW DISTILLATE FIELDS

Reagan County. The Texas Co.'s State of Texas "AF" 1, Section 9, Block 11, University Lands Survey, ½-mile south extension, flowed 254 barrels distillate and 9.7 million from Fusselman lime, Silurian 9442-54 feet, 1-inch, 72.3-gravity, completed 4-20-53, TD 9752.

Schleicher County. Humble's Mrs. Olivia Spencer 1, Section 176, Block A, HE&WT Survey, gauged 27 barrels



READINGS YOU CAN DEPEND ON

The SINGLE SHOT

The Sperry-Sun Single Shot gives a photographic record of inclination and direction at any point in the well bore. And this record is one you can depend on because the record indicates clearly a faulty reading caused by a moving instrument.

The Single Shot may be lowered on a wire line into the open hole or into a Non-Magnetic Drill Collar; or it may be go-deviled into the Non-Magnetic Drill Collar. Interchangeable angle units permit recording from 0° to 20° and 0° to 90°. Daylight loading and developing accessories are supplied with the instrument.

Call your nearest Sperry-Sun office for full details or look in your new Composite Catalog.

SPERRY-SUN SERVICE POINTS

HOUSTON, TEXAS
CORPUS CHRISTI, TEXAS
MARSHALL, TEXAS
ODESSA, TEXAS
OKLAHOMA CITY, OKLA.
LAFAYETTE, LA.
LONG BEACH, CALIF.
BAKERSFIELD, CALIF.
VENTURA, CALIF.
CASPER, WYOMING
FARMINGTON, N. M.
INTERNATIONAL GAS LIFT, S. A., CARACAS, VENEZUELA
UNITED DRILLING SERVICES, EDMONTON, ALBERTA, CANADA

SPERRY-SUN WELL SURVEYING COMPANY

3118 BLODGETT AVENUE • HOUSTON, TEXAS

Standard Oil Company (New Jersey) reports on...

A big job...well in hand

(Highlights from the Annual Report for 1952)

People needed more oil in 1952 than ever before, but once again ample supplies were available to meet the demand. An important part of this big job was done by companies in which Standard Oil Company (New Jersey) has investments. These companies expanded their facilities to provide people of many nations with oil to heat and light their homes, fuel their ships and planes and trains, power and lubricate their factories, harvest their crops, and run their cars and trucks.

Jersey's Annual Report for 1952 shows how the big job of supplying people's oil needs has become even bigger. It shows, too, how well this kind of American enterprise handles it.

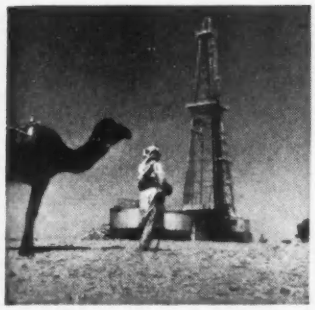
During 1952, Jersey's affiliated companies produced, refined and sold more oil than in any previous year. This meant more oil wells, more miles of pipe line, new tankers, additional refining capacity, and expanded distribution facilities.

It also meant large investments. During the year, new equipment and replacements cost $498,000,000. Since 1945, *almost three billion dollars* have been spent for this purpose.

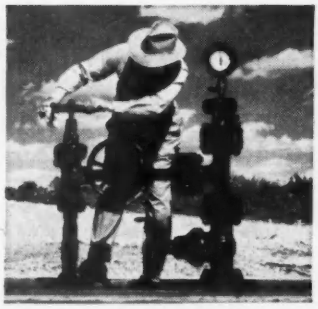
The increased business brought to Jersey and its consolidated affiliates a record gross income for the year, but because of the higher costs of doing business, *net* income was $8,480,000 less than 1951's record high. About half of this net income of $520,000,000 was paid in dividends to the 269,000 persons who own Jersey.

These pictures give some idea of the scope and scale of Jersey affiliates' activities during 1952:

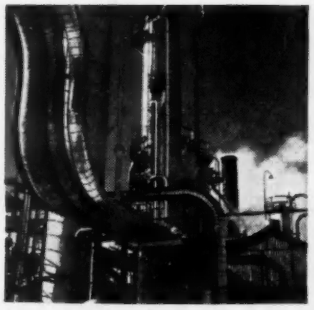
New Oil Sources are located by constant search and by using modern equipment like this helicopter in Canada. New fields were also sought, with good success, in the U. S., South America, Western Europe, the Middle and Far East.



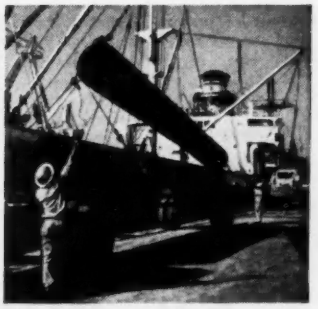
When Geologists Find a Likely Spot, or when known fields are being developed, new oil wells must be sunk, often at great cost. Here is a drilling rig in a project which expanded the known boundaries of an oil field in Saudi Arabia.



Many New Wells, such as this opening a Texas field, must be placed in operation yearly to meet demands. In 1952, although production of Jersey affiliates was 4 times that of 20 years ago, their proved reserves were at an all time high.

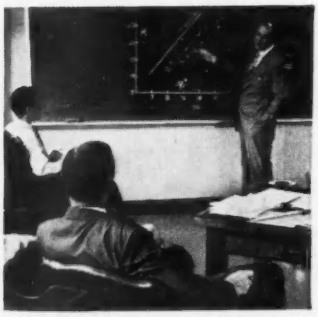


New Refining Capacity helps to meet the need for more and better products. The units shown above, for example, represented an important part of a recent modernization and expansion program at a Jersey affiliate's refinery.



Pipe Lines are costly, but provide the most efficient overland transportation of petroleum. This means cheaper, more abundant products. The pipe shown above went into a line delivering crude oil to a Venezuelan refinery.

Tanker Construction goes on constantly to meet requirements for water transportation of crude oil and finished products. During 1952 Jersey affiliates took delivery of two new ocean-going tankers like the one shown above, as well as four smaller tankers.



New Ideas are essential to meet people's needs for more and better oil products. Over $27,000,000 and the time of 2,500 employees were devoted to research in 1952. Notable results included a motor oil to maintain efficiency of high compression automobile engines.

FINANCIAL SUMMARY—1952

Standard Oil Company (New Jersey) and Consolidated Affiliates

Total income from sales, services, dividends and interest	$4,156,977,000
Net income	$519,981,000 or $8.58 per share
Dividends paid	$256,882,000 or $4.25 per share
Wages and other employment costs	$670,200,000
Taxes charged to income	$371,600,000
Other taxes, collected for governments	$384,500,000
Spent for new plants and facilities	$498,051,000
Number of shareholder-owners	269,000
Number of employees	120,000

The Annual Report tells the story in detail. We will be pleased to send a copy to anyone wishing it. Write Room 1626, 30 Rockefeller Plaza, New York 20, N. Y.

STANDARD OIL COMPANY (NEW JERSEY)

AND AFFILIATED COMPANIES

ESSO

distillate and 9.5 million from Strawn sand, Pennsylvanian 6736-6870 feet, open, 64.2-gravity, completed 4-10-53, TD 6978.

TEXAS DISTRICT 8—NEW OIL FIELDS

Andrews County. Lubbock Machine & Supply Co.'s Logan & Parker 1, Section 14, Block A-46, PSL Survey, pumped 164 barrels from San Andres lime, Permian 4482-4645 feet, 2-inch, 38.1-gravity, completed 4-21-53, TD 4659.

Ector County. Cities Production Corp.'s Cross "E" 1, Section 44, Block 43, T2S, T&P Survey, flowed 321 barrels from San Andres lime, Permian 4264-4340 feet, 26/64-inch, 34.4-gravity, completed 3-27-53, TD 4340.

Unnamed field. Forest Oil Corp.'s TXL "L" 1, Section 31, Block 43, T1N, T&P Survey, flowed 261 barrels from Pennsylvanian sand 8621-31 and 8671-91 feet, 12/64-inch, 40.2-gravity, completed 1-30-53, TD 11,902.

Gaines County. Forest Oil Corp.'s E. H. Jones "A" 1, Section 10, Block A-7, PSL Survey, pumped 221 barrels from Devonian lime, Devonian 11,258-268 feet, 2-inch, 41.9-gravity, completed 4-20-53, TD 11,301.

Howard County. Stanolind's Minnie Smith 1, Section 45, Block 31, T-3-N, T&P Survey, pumped 28 barrels oil and 8 barrels water from Canyon Reef lime, Pennsylvanian 7773-96 feet, 40-gravity, completed 4-27-53, TD 7851.

Mitchell County. Robert L. Wood et al's Ross Dixon 1, Section 2, Block 12, H&TC Survey, flowed 45 barrels from Strawn sand, Pennsylvanian 6234-54 feet, ½-inch, 44.3-gravity, completed 4-18-53, TD 6400.

Ward County. Argo Oil Corp.'s John Olson 1, Section 191, Block 34, H&TC Survey, flowed 42 barrels oil and 29 barrels water from Delaware sand, Permian 4984-88 and 4993-99 feet, ¾-inch, 38.2-gravity, completed 4-28-53, TD 5132.

Yoakum County. H. L. Lowe's Webb "L" 1, Section 477, Block D, J. H. Gibson Survey, pumped 25 barrels from San Andres lime, Permian 5314-18 feet, 31-gravity, completed 4-15-53, TD 5318.

TEXAS DISTRICT 8—OIL FIELD EXTENSIONS

Borden County, Von Roeder field. Magnolia Petroleum Co.'s Conrad "C" 4, Section 55, Block 25, H&TC Survey, ½-mile south extension, flowed 139 barrels from Canyon Reef lime, Pennsylvanian 6787-6812 feet, 13/64-inch, 44.6-gravity, completed 4-15-53, TD 6812.

Pecos County, Fort Stockton field. C. H. Priddy, W. S. Montgomery, R. G. Baker et al's Leon Land & Cattle Co. 1, Section 3, Block 203, T. Walters Survey, 1½-mile west extension, pumped 10 barrels from Yates sand, Permian 2756-76 feet, 33.6-gravity, completed 3-24-53, TD 2999.

Terry County, Prentice field. Joseph I. O'Neill, Jr. et al's Mrs. Ella Covington 1, Section 21, Block D-14, C&MRR Survey, ¾-mile northeast extension, pumped 154 barrels from Glorietta lime, Permian 5967-81 feet, 2-inch, 31.5-gravity, completed 4-10-53, TD 5981.

TEXAS DISTRICT 10—NEW OIL FIELD

Roberts County. Gulf Oil Corp.'s Grace McCuistion Estate "A" 1, Section 193, Block M2, BS&F Survey, pumped 80 barrels from Haggard sand, Permian 4086-4110 feet, 50-gravity, completed 3-8-53, TD 4110.

WYOMING—NEW OIL FIELDS

Big Horn County, Coon Creek area. George J. Greer's Government-J. E. Pepper 2, NE SE NE 22-55n-97w, pumped 28 barrels from Frontier sand, Upper Cretaceous 4612-33 feet, 44-gravity, completed 4-29-53, TD 5091.

Park County. The California Company's Rawhide Unit 1, NW SW SE 4-48n-101w, pumped 32 barrels oil and 53 barrels water from Phosphoria lime, Permian 5057-85 feet, completed 3-26-53, TD 6200.

Weston County, Clareton, Southwest area. Voss Oil Co.'s Scott 1, SW NW SE 23-42n-66w, pumped 206 barrels from Newcastle lime, Upper Cretaceous 6868-76 feet, completed 4-26-53, TD 6895.

OIL FINANCING

Our technical and financial knowledge of the oil industry is available to principals of independently or family owned oil and gas properties. If you are contemplating a loan against present production or considering the acquisition or sale of producing holdings, our specialized experience may be helpful.

C. LESLIE RICE, JR. — *Vice President*

J. F. DOUGHERTY — *Vice President*

Oil Department

Empire Trust Company

7 WEST 51st STREET

at Rockefeller Center, New York, N. Y.

CATCH THAT "*Thief*" FORMATION with

"Pit-O-Graf"

KNOW AT ONCE WHEN THE HOLE TAKES MUD

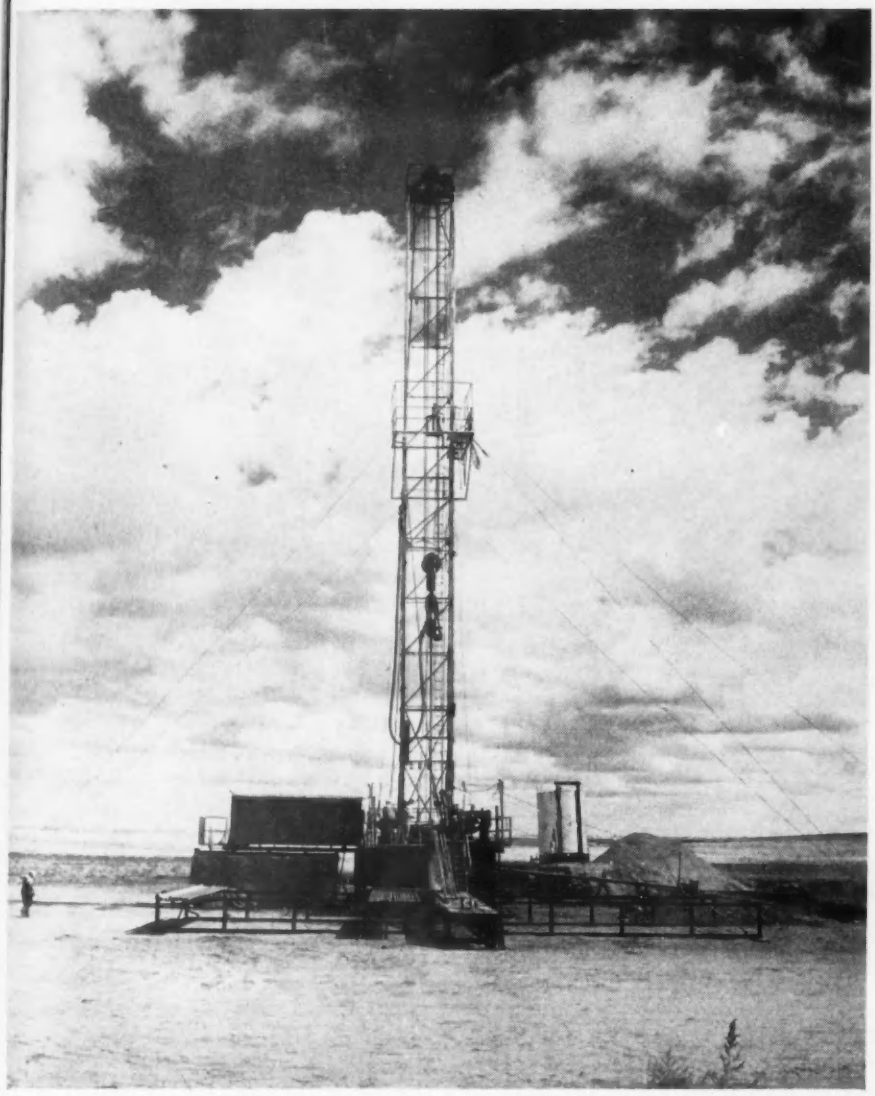
The Pit-O-Graf chart shows the instant lost circulation begins by recording a decrease in mud pit level. *It enables action to be taken at once, while there is still time.* An increase of mud in the pit, which is shown immediately on the chart, means gas or salt water. The crew has time to take action to avert a blowout. Pit-O-Graf is a completely automatic recording instrument which measures the mud pit level. With the recording unit right before the driller, he is aware at once of any increase or decrease in mud volume. Pit-O-Graf allows preventive action to be taken at once. You need Pit-O-Graf in lost circulation areas and for every wildcat.

WARREN AUTOMATIC TOOL CO. — WATCO — HOUSTON

WARREN AUTOMATIC TOOL CO.

1920 HUSSION STREET, HOUSTON, TEXAS

Manufacturers and Distributors of Mud-O-Graf and Rig Runner



The Ohio Oil Company's slim hole rig drilling at 6500 feet in Kimball, Neb., area. Small diameter bore has cut the costs of exploratory drilling. The hook load at this depth is 38,000 pounds.

Ohio's Slim Hole Rig Cuts Exploratory Drilling Costs

Here are the findings of an experiment conducted in western Nebraska.

By GERALD BURGESS, Drilling Superintendent,
and H. D. HOOPMAN, Drilling Foreman,
The Ohio Oil Company, Casper, Wyo.

HUNDREDS OF THOUSANDS of dollars can be saved annually by using core hole drilling tools in exploratory drilling. The feasibility of drilling exploratory wells by core hole methods at an objective cost of ⅓ to ½ of conventional wildcatting depends upon choice of drilling locations and objective depths which are most favorable to this type of drilling.

Statistics show there is a new discovery well for every eight wildcat wells drilled. Assuming that an exploratory program would attain about the same average, it is evident that savings on dry hole ventures would more than offset additional cost of completing a core hole discovery well.

An experiment in exploratory drilling has been conducted in western Nebraska by The Ohio Oil Company during the past year. The operation is referred to as core hole drilling. But the terminology is vague and requires considerable definition to narrow this title to the techniques to be discussed. A well bore drilled by the methods described is primarily an exploratory hole. It is not intended to complete such a hole as a commercial producing well without additional drilling or reaming, a procedure which will be discussed later. It is also intended that:

- Only one string of casing be set at a sufficient depth to protect surface water.
- The smallest practical well bore diameter be used to reach an objective depth sufficient to test prospective pay zones.
- Full sample core, electric log, and drill stem test information be obtained during the drilling process.

The purpose of core hole exploration is to obtain stratigraphic information and evaluate the possibility of petroleum production at a reduced cost as compared to standard wildcat drilling.

Observation

1. The general and largest objection to the use of the small rig in the Sidney area was the fact that in drilling an 8¾-inch hole through the Niobrara section, the shale was prone to swell and close the well bore to the extent that it became extremely difficult to withdraw the bit. However, with the small bore, this condition does not exist. This probably is due to the high annular velocities, ranging from a maximum of 450 feet per

Wire line core barrel was responsible for the success of the core hole technique. Here Drilling Foreman H. D. Hoopman and Geologist Dean Ringle inspect cores. Core barrel assembly is displayed on the pipe rack. Bit size 4¼ inch by 1¾ inch.

minute on the 2⅞-inch OD to 660 feet per minute on the drill collars and tool joints.

2. Coring cost may be reduced as much as 65 percent.

3. Trucking costs reduced by 30 percent.

4. Rig investment would probably be reduced about 50 percent of the cost of a unit to drill a comparable maximum depth in the standard hole.

5. Labor costs could be reduced by 35 percent. (Trips have been made from 5000 feet with one man on the floor in practically the same time as with two men.)

6. Drilling fluid cost would be reduced to a minimum due to the small volumes needed.

7. Fuel cost reduced approximately 35 percent.

8. Water costs cut by approximately 60 percent.

9. Surface pipe and cement costs reduced as much as 50 percent.

Disadvantages

1. The rock bit life is relatively short as compared to the 8¾-inch bits. This is usually due to early bearing failure, tooth length and the fact that there is very little selection of bit types, which of course tends to retard the penetration rates in the broken formations.

2. It is impossible to wash over the drilling string should the pipe become stuck; however, in considering the reaming rate on the J. F. Beyer well, the hole could be reamed to the top of the fish, and a diamond washover shoe run.

3. Still another disadvantage is the necessity of reaming the hole for the oil string in wells where production is found. However, the original contention, that a small bore could be reamed and completed for a cost that would be in line with standard prices, was reflected in the completion of the Beyer well.

4. The selection and training of personnel for this particular type operation constitutes quite a problem. Not more than one out of every six drillers has the qualifications to execute the necessary efficient and intelligent job. Unfortunately, the old general line of thinking seems to prevail to the extent that the larger the rig the greater the honor. However, Ohio was fortunate in having a large number of men to select from, and those who were chosen for this experi-

Coring Cost Comparison

1800′ of Coring

	Slim Hole	Conventional Wire Line	Diamond 6⅛″
Core Bits, per Ft.	$ .56	$ 3.68	$ 4.79
Core Cost, per Ft.	$ 12.16	$ 18.46	$ 31.46

Drilling Bit Comparison

	4¾″	8¾″	13¾″
Rock	$ 68.70	$164.50	$287.00
Average Footage	726 Ft.	1016 Ft.	....
Drag	$ 26.40	$ 71.85	....
Average Footage	1017 Ft.	1426 Ft.	....

Truck Load Comparison

	Depth Range	No. of Equipment Loads	Cost for 100 Miles
Slim Hole Unit	6500	9	$1,525.00
Conventional Rig 1	3000–5500	17	$3,875.00
Conventional Rig 2	4000–7000	24	$5,505.00
Conventional Rig 3	7500–9500	33	$9,100.00

Actual Hook Load Comparison

	Depth Feet	Hook Load	Mast Capacity	Portion of Mast Capacity Used
Slim Hole Rig	6500	38,000	150,000	25.33%
Conventional Rig 2	6500	127,000	480,000	26.46%
Conventional Rig 3	6500	139,000	760,000	18.29%

Surface Loads

Block, Hook, Swivel, Kelly, Bushings, Elevators and Bails

Slim Hole Rig	4,186 lbs.
Conventional Rig 2	14,508 lbs.
Conventional Rig 3	19,750 lbs.

(The 19,750 lbs. as shown for the Conventional Rig 3 is also the weight of the Slim Hole, Hook Load at a depth of 3300 feet).

Force required to move weight is horsepower and horsepower is dollars.

Comparative bit sizes for slim bore and conventional. Left to right, bits 1 and 2, 3⅞-inch for drilling out in 4½-inch casing and 6⅛-inch for 7-inch casing; bits 3 and 4, wire line core bits 4¼-inch for slim bore and 7⅝-inch for standard hole; bits 5, 6 and 7, main bore bits, 4¼-inch and 8¾-inch; bits 8 and 9, 9-inch surface bit and 15-inch bit for standard hole. Co-author Hoopman inspects bits.

ment are definitely sold on the "Slim Hole Rig."

Theory. The original theory of core hole drilling called for continuous coring from under surface to the objective depth. The accomplishments of the mining industry in coring deep holes was cited as the basis for penetration and cost estimates. All concerned were impressed with the idea that core hole operation would be economically practical only in the hard rock areas where continuous diamond coring could be made competitive with normal drilling practices.

The feasibility of deep, continuously cored holes of small diameter has been proved by the mining industry. Many holes from 400 to 6000 feet deep have been continuously cored in this country and depths of 8000 to 10,000 feet are not uncommon in Africa. The mining industry has been digging core holes in hard rock for some 35 years and has developed equipment and techniques which enable them to do the job cheaply and efficiently. It seemed logical that a similar well bore could be made suitable for petroleum exploration at a comparative cost. In areas considered most favorable for core hole operations, drilling costs are considerable. For example, in Wyoming and Montana, wells drilled to 8000 feet often exceed $18 per foot, and costs in excess of $25 per foot are not unusual in 11,000-foot holes.

It is obvious that when the bore hole diameter is reduced from 9 to 4¾ inches, all of the equipment necessary to drill the hole can be reduced proportionately. Initial investment for the rig is reduced, all operational costs such as moving, maintenance, labor, depreciation and supplies will also be reduced on a "per day basis." Any cost-per-day advantage gained by using small equipment is rapidly offset if the time required to drill a core hole does not compare favorably with the time required to drill a like footage by conventional rotary tools.

The Mining Core Hole. A survey was made of mining equipment and techniques. It was found that while mining core drills are extremely portable, they are often obsolete as compared to petroleum drilling equipment. One of the core drilling units visited was drilling at 4965 feet and was one of 22 rigs owned and operated by a contractor having units in Wyoming, Utah and Montana. This unit had the following equipment:

HOIST AND ROTARY DRIVES: The unit was powered by a V-8 engine and used a single line for pulling and running drill rod. The rotary had a manual chuck, and a hydraulic power feed mechanism. This unit was about 35 years old and had been converted from a steam driven unit. It was in good repair and not considered particularly obsolete by the operator.

CIRCULATING PUMP: A triplex pump was neatly unitized and skid mounted with a 15 HP multi fuel engine and coupled, using a torque converter. Maximum capacity of the pump was 20 gallons per minute at 200 psi. Average circulation rate used while coring was 10 to 15 gallons per minute.

DERRICK: The 38′ wood derrick was a tripod structure with 6″ x 8″ spliced timbers for legs, sway braced with 2″ material. A single sheave was hung in the top as a crown sheave.

DRILL RODS, BITS AND CASING: Mine drilling is set up on the following standard size hole, drill rod, and casing:

N X - 3″ hole 2″ drill rod 2¾″ OD Casing
D X - 2 7/16″ hole 2″ drill rod 1⅞″ OD Casing
E X - 1½″ hole 1¼″ drill rod

Approximate diamond plug bit and

core head costs are:

	Cuts	Cost
3" Core head.....	2½" core	$ 85
2 7/16" Core head....	1½" core	75
1½" Core head....	⅝" core	65
3" High Crown plug bit.....		125
2 7/16" High Crown plug bit.....		105
1½" High Crown plug bit.....		80

Techniques: Clear water is used for drilling in order to recover sludge (samples) for analysis. The fact that gel cannot be used creates the necessity of cementing or casing the hole as a means of controlling lost circulation and hole sloughing conditions. A two-man crew is used which consists of a driller and a derrick man. The driller handles all floor work in making trips. The pipe is racked in the derrick in three 10-foot lengths per stand. Coring is done using a 10 to 20-foot-long barrel and core recovery is made by pulling out of the hole to unload the core barrel.

The rig just described appeared to be obsolete by oil field standards, although it was in good repair and doing an efficient job of core drilling. It was generally agreed that the mining core drills now operating would not be adequate for oil field wildcat drilling. However, the survey did convince our drilling personnel that the elaborate equipment of the normal wildcat rig was not necessary to drill a small diameter test well.

Design of Core Hole Rig for Petroleum Exploration. Early in 1951, The Ohio Oil Company investigated the possibilities of drilling small diameter exploratory wells and assembled equipment and personnel for a series of tests. The problem had changed from designing a diamond core hole rig, suitable for drilling only selected locations at an objective cost of ⅓ to ½, to designing a rig suitable for drilling small diameter holes or core holes in any type of formation encountered at an objective cost substantially below normal wildcat well costs.

Hole Size: For initial test wells, it was considered impractical to reduce the hole diameter below the minimum required for presently available electric logging and drill stem testing equipment. The minimum size of logging and testing tools in common use measure 3¾-inch outside diameter and can satisfactorily be operated in a 4¼-inch bore hole. A minimum hole size of 4¼-inch was therefore chosen for coring. Since it is desirable to maintain a larger diameter bore above the cored hole, a 4¾-inch size was chosen for the well bore proper.

Drill Pipe: Many of the rig design features are dependent upon drill pipe specifications. 2⅞-inch EUE—N80, 6.5-pound, Range 2 tubing was chosen as the drilling string for the following reasons:

- Internal Flush: Since the rig was to be designed as a core hole unit, the method of core recovery is of prime importance. Core recovery by reverse circulation or by wire line methods is considered essential and internal flush pipe of as large internal diameter as possible is required. 2⅞-inch tubing provides an internal flush drilling string of 2.441-inch inside diameter, which is larger than the ID of any comparable standard drill pipe.

- Light weight: The difference between 10.40 pounds per foot for 2⅞-inch drill pipe and 6.5 pounds per foot for the tubing chosen becomes an appreciable item in determining the mast and drawworks required capacity.

Rig Type and Capacity: The rig was a single drum servicing hoist, recommended for well servicing to 9000 feet. It was equipped with one 180-HP diesel engine and a 94-foot 150,000 pound mast was converted and mounted on a tandem trailer. This unit, though quite mobile, is still considerably heavier than is necessary for 5000-foot drilling. Due to both weight and height, it is necessary to remove the mast for long highway moves.

Rotary Table: Because of the low torques anticipated the standard table drive unit would not be in proportion to the balance of the rig. Therefore a unitized rotary drive was made in Ohio's Casper shop using a 10-inch oil bath rotary table having a 63,400 pound load rating coupled to a 38 HP gasoline-natural gas engine through a 1.2:1 reduction transmission and a 12.2 twin disc hydro sheave. The hydro sheave-to-table coupling was accomplished with the use of four "C" section belts, the sheaves being of the demountable hub type in order that the rotary speed and torque could be controlled. It is believed, from all indications, that this unit would have a capacity sufficient for drilling to depths of 10,000 feet.

During the drilling of the F. Beyer 1, excessive slippage was experienced in the hydro sheave, when it became necessary to ream to the 6¼-inch hole. The hydro sheave was removed and a positive hookup was installed. This set up is now in use and has proved to be satisfactory in this operation.

Drill Pipe Handling Equipment: Automatic power tubing tongs are used to make up and break out drill pipe, drill collars and subs. Special 2 13/16-inch jaws are provided to fit tool joints and drill collars. Interchangeable 2⅞ and 2⅜-inch jaws also are available on the rig.

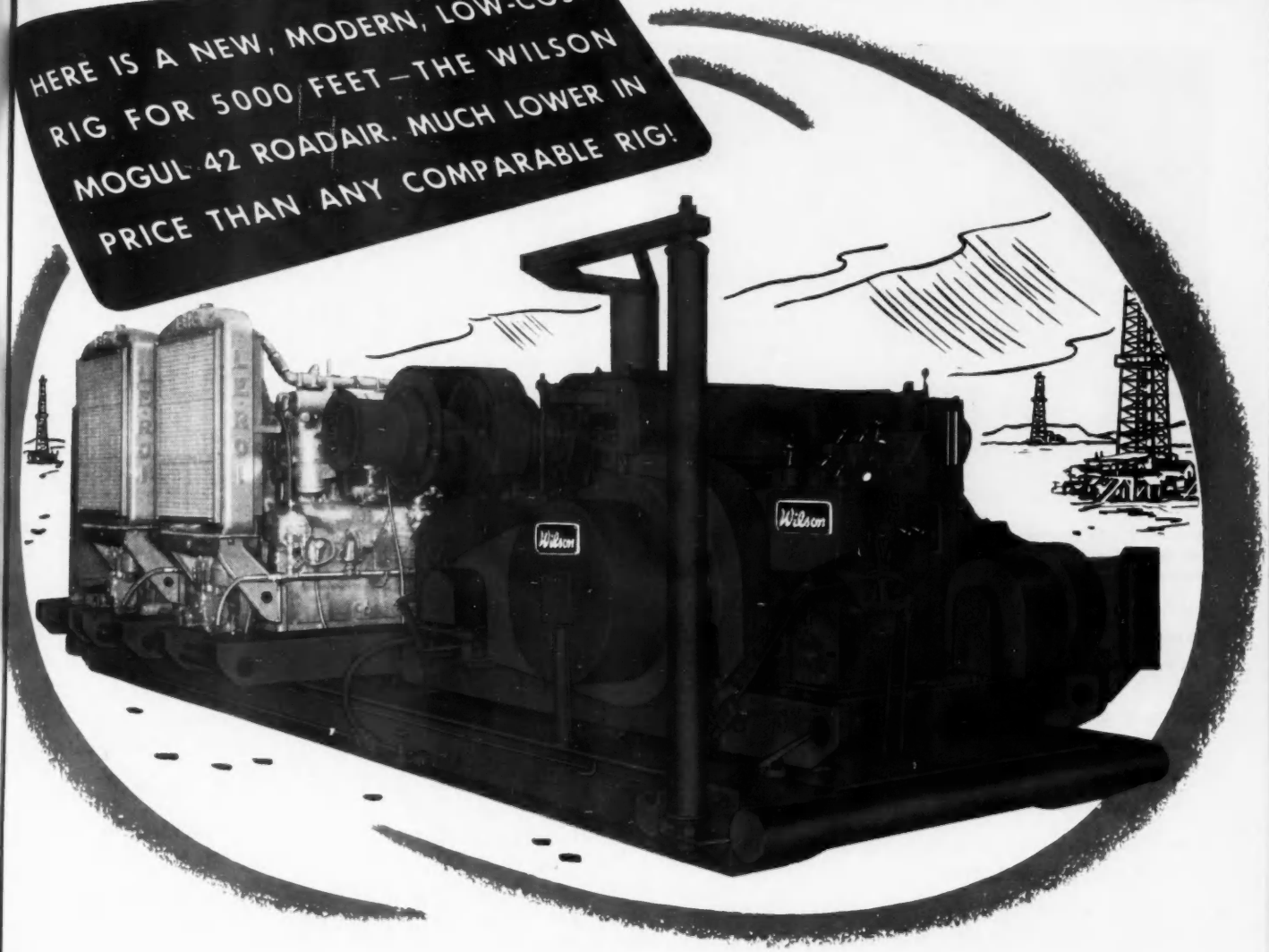
Two wide faced tubing tongs designed for light drilling are provided. One set is hung on the off driller side and used as a backup in making up and breaking out connections. This tong is rolled over in its bracket to change the direction of tonging action. The other tong is used in conjunction with the spinning cathead in case the air tongs fail.

Hand slips are used to make connections and handle drill collars. Air-operated power tubing spider and slips have been fitted with an adapter to fit the master bushing hole in the rotary table. These slips are used on trips and are actuated from the driller's position.

Air for the tongs, slips, clutches, and controls is provided by a compressor. This compressor is driven from a shaft takeoff on the drawwork's main transmission, and although it was originally suggested a 32 cubic foot per minute would be needed, the 21 cubic foot compressor furnishes a sufficient supply of air for all operations.

Mud Circulating Equipment: Two unitized pumps were used on the first three test wells to provide flexibility in circulation rates. A 150-HP duplex slush pump dressed with 5½ x 12-inch liners and driven by a 235-HP natural gas-butane engine was used while drilling. To drill the relatively soft, sticky shales encountered in western Nebraska, an excess of fluid circulating capacity is desirable. The diamond core barrel was designed for a circulation rate of 85 to 100 gallons per minute; therefore, it was necessary to use a smaller pump. A 50 HP pump driven by a 136-HP

HERE IS A NEW, MODERN, LOW-COST RIG FOR 5000 FEET—THE WILSON MOGUL 42 ROADAIR. MUCH LOWER IN PRICE THAN ANY COMPARABLE RIG!



"after all—the only thing we're talking about is MONEY"

The Mogul Roadair "42" Rig was designed to meet the need of those customers who want a rig *with compounded engines* of up to 400 H.P. total, to drill wells up to 5000 feet with 4½" pipe, without torque converters, and at the lowest total cost. This rig more completely fills all of these requirements than any rig we know. Of the 400 engine horsepower, 300 can be used on the pump and about 100 on the rotary table, and yet all 400 H.P. will be available when coming out of the hole.

The rig also has the safety and dependability inherent in having two engines, with compound, so that either can be used in the event of failure of the other. The V-belt compound is designed to use the high strength steel cord V-belts, which are run at fairly high speed, to carry relatively large H.P. in a narrow width.

It is equipped with a 118 Air-Tube disc engine clutch in a positively aligned clutch housing, which has proved so successful in other Wilson Roadair and Torcair Rigs.

The drum assembly in this rig is exactly like the regular Mogul Torcair "42" rig, which has two friction clutch drum speeds. But in addition it has a two speed jaw clutch transmission in a heavy plate case. The brake rings are "42" diameter, and brakes are 8" wide, full wrap type and cam and roller operated.

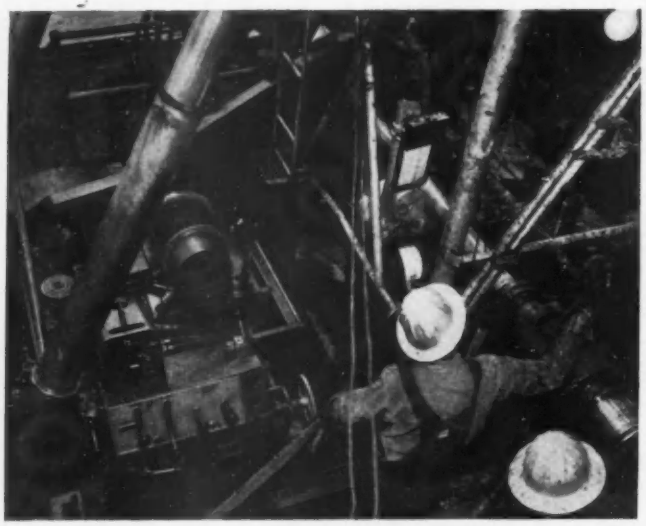
This is a fast, dependable rig, at the lowest possible cost, that will make possible *lower drilling costs than any other rig of comparable size!*

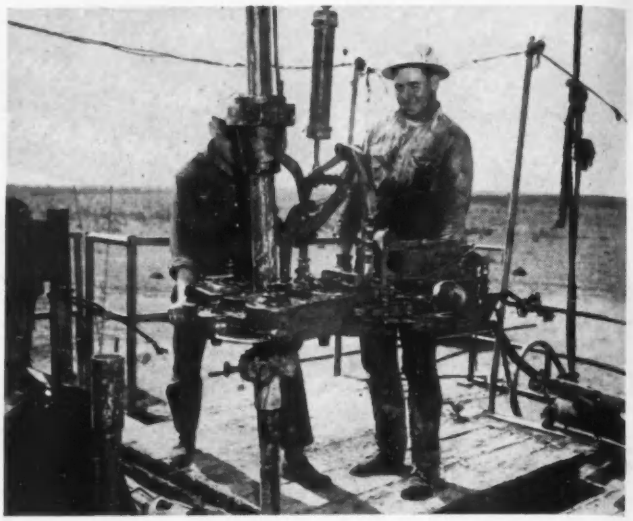
Compare Features... Quality... Prices

Wilson

MANUFACTURING CO., Inc.

WICHITA FALLS, TEXAS





Maximum core recovery depth is 6517 feet to date. Measuring reel at left is used to recover cores. A six-horsepower gasoline engine powers reel carrying a .092-inch line. Above driller's head is continuous recording instrument logging footage against time. Right, a mousehole connection is made using power tongs and backup tubing tongs.

gas-gasoline engine with a four-speed transmission was used while coring.

From experience gained in drilling the first three wells the following pump requirements were derived:

- For drilling: A maximum of 225 GPM at 750 psi was sufficient.
- For coring: 85 to 100 GPM at 550 psi was desirable.

A single unitized 50-HP pump was set up and is now used for both drilling and coring. A 210-HP gas-gasoline engine equipped with twin disc torque converter is coupled to the 50-HP pump using a 1¼-inch triple chain drive. Although this combination exceeds the rated horsepower of the pump using 5-inch liners, no difficulties have been encountered to date.

Blowout Preventers: A 6-inch nominal torus type zero-close preventer was purchased for this test. It is hydraulically operated and has a full closing element that will seal on any size pipe or will close off the open hole. For additional protection a six-inch combination stripper and rotating double preventer assembly was installed below the torus type preventer. The lower preventer may be hydraulically or manually operated and is dressed with 2⅞-inch tubing rams in the top, and blind rams in the bottom. Both preventers are actuated by a hydraulic pump mounted on the drawworks engine and controlled by valves mounted at the driller's position.

Fishing Tools: In case of a twist-off, a releasing spear with a fluid packoff assembly will be used as a fishing tool. Clearance between the pipe and hole is insufficient to accommodate an external overshot.

Kelly: The 3⅜-inch OD x 36-foot long, round fluted kelly is used equipped with 2⅜-inch IF right and left hand joints. The 3⅜-inch OD size was selected, with the thought in mind that, in the event it was decided to use 5½-inch surface pipe, the kelly would be adaptable.

The 60-ton swivel now being used is no doubt a good deal heavier than is necessary for wells up to 6500 feet; however, it has been quite satisfactory.

Drill Collars: The drill collars are 3¾-inch OD x 2⅜-inch ID x 30 feet, and are equipped with the same tool joint connection as the drill stem. During our drilling and coring operations six of these drill collars are used. Double box subs, bored for drill pipe float assemblies, are used for the bit to drill collar connection.

Application of Conventional Bits: Most of the oil field drilling with small bits up to and including the 4¾-inch bit has been for one of the following purposes:

- Shot hole drilling for geophysical surveys. These holes are relatively shallow and drilled primarily with drag bits. Inexpensive bits have been developed which give excellent penetration in very soft zones.
- Completing or deepening wells which have 5½-inch casing set. This job usually involves drilling harder, more abrasive zones. In our case diamond bits would be used.

The type of formation now most unfavorable to core hole operation is between the very soft, which is readily handled by drag bits, and the very hard formation, which is efficiently dug with diamond equipment. Sticky shale, interbedded sand and shale sections, which are normally drilled with softer type rock bits on standard rotary rigs, offer a problem in the core hole.

Ohio's analysis of areas favorable and unfavorable to slim hole drilling may have been influenced by the performance of available bits in the various types of formations encountered. Through experience and design the industry will be able to develop small diameter equipment and techniques that will drill these intermediate sections efficiently and competitively from a time standpoint, thereby extending the area in which core hole operation will be economical.

The design of a bit with tungsten carbide races, a special heat treated bearing and a lengthened tooth pattern, may eliminate the short bearing life and will increase the penetration rates through broken formations.

Core Recovery Unit: Core recovery has been entirely by wire line methods. A measuring reel equipped

PARTNERS IN PROGRESS

. . . The Second National Bank of Houston and the Oil and Gas Men It Serves

It isn't just the number of oil men we serve that makes Second National of Houston one of the country's leading oil banks. Far more important is the *kind* of relationships that exist between us and our customers in the oil and gas industries . . . close, cordial, cooperative relationships founded on an unusually thorough program of service.

As regular customers of this bank, oil and gas men follow a practice of discussing their plans and problems with the engineers and geologists of our Oil and Gas Division . . . all men of practical experience in oil and gas operations. Specialists in many other fields stand ready to work with them in matters involving business or financial management. Throughout the organization they find interest that is deep and sincere, backed by service that is broad and cooperative.

The result is a community of interests that adds extra value to the banking relationship. That is why more and more members of the oil and gas industries are selecting Second National of Houston as their bank. That is why you also will find it to your advantage to investigate the advantages of a banking relationship with this progressive, service-minded bank, conveniently located in one of the world's great oil centers.

46 Years of Service to the Southwest

The SECOND NATIONAL BANK OF HOUSTON

MAIN AT RUSK

CAPITAL AND SURPLUS 15 MILLION DOLLARS

Member Federal Deposit Insurance Corporation

with .092 piano wire line and driven by a six-HP air-cooled engine is used to handle the overshot. The overshot assembly consists of a wire line overshot on a six-foot sinker bar that is attached to the wire line by means of a socket. Ten foot cores have been pulled from 6500-foot depths.

The possibility of belting the reel to the cathead shaft which would eliminate the necessity of the six-HP air-cooled engine is currently being considered.

CORE BARREL: The success of core hole drilling depends considerably on the efficient operation of the core barrel. The following set of rigid specifications were set up for a suitable barrel:

- Core recovery must be virtually 100 percent.
- Cut a core 1½ inches or larger in diameter to provide a sample large enough for analysis.
- Coring penetration rates should be high.
- Core recovery should be possible at any time so that inspection of the core could be made at short intervals with a minimum of lost time.
- Core head investment and replacement cost should be held to a minimum.

A survey was conducted of the core barrels now available for mining and petroleum drilling. No presently manufactured coring equipment met all of these specifications. Therefore, an attempt was made to design a suitable barrel. The basic design was worked out and turned over to a diamond products manufacturer for fabrication. The core barrel, as finally manufactured, has a 4¼ x 1¾-inch diamond core head on a 3¾-inch x 10-foot outer barrel. The inner barrel which has an integral core catcher assembly receives the 1¾-inch diameter core as it is cut. This inner barrel, containing a core, can then be retrieved by wire line methods, or by reverse circulating if hole conditions are favorable. The inner barrel is held in place by passage of drilling fluid through a choke restriction between the top of the inner and outer barrels. When circulation of drilling mud is stopped or reversed the inner barrel, containing a core, is free to be recovered. This design eliminates need for inner barrel bearing assembly or a hold down latch assembly.

On the first five wells 2649 feet of core had been cut using this barrel and the coring efficiency is such that a large scale barrel of similar design has been manufactured for use with 4½-inch IF modified drill pipe.

Operation. The rig was moved from Grass Creek, Wyo., to the Niebuhr 1, 16 miles north of Sidney, Neb. The moving and rerigging of equipment on this first job took seven days.

A 9-inch hole was drilled to 215 feet, and 7-inch OD, 20-pound, H-40, 8 rd. thd. casing was set at 199 feet and cemented with 35 sacks of cement. Waiting-on-cement time was 24 hours.

A 4¾-inch hole was drilled to 4735 feet (top of the first Dakota) and 107 feet was cored. Three drill stem tests were taken in the first and third sands with one 3¾-inch OD packer being used each time.

An electric log was run to the total depth without any difficulty; however, in our attempt to run a microlog the first major problem was encountered. Because of the wide expansion of the sonde pads it was necessary to tape one of them down tight, and to restrict the expansion of the other pad to some extent, but even then it was only possible to get within 69 feet of total depth.

During one operation of pulling the pipe from a depth of 2900 feet the drill stem was stuck at 950 feet which required the loss of 12 hours time for spotting oil in order to free the pipe. Reoccurrence is not likely as the crews and all concerned have been informed of the necessity of maintaining an absolutely full hole at all times to prevent the quicksand below the surface pipe from unloading.

The rig then was moved to the J. F. Beyer 1, a distance of 12 miles, where the same procedure was followed. The first sand was topped at 4781 feet. One hundred thirty-two feet was then cored and four drill stem tests taken. The first sand proved to be productive and the third sand to contain only salt water. One hundred one feet of hole was drilled between the first and third sands resulting in a final total depth of 5015 feet.

As the first sand contained commercial quantities of oil the next step was how to complete the well. Move in a heavy rig and drill another hole? Or complete the well with the core hole unit? It was decided to use the small rig and to ream the 4¾-inch bore to 6¼ inches, and run a string of 4½-inch OD, 9.5-pound, J-55 casing. This operation required 2⅔ days, with the use of three 6¼-inch rock bits. After allowing 36 hours for WOC time the plugs were drilled with a 3⅞-inch bit. The 2⅜-inch OD, UE tubing was then run and the well completed for 85 barrels of oil per day.

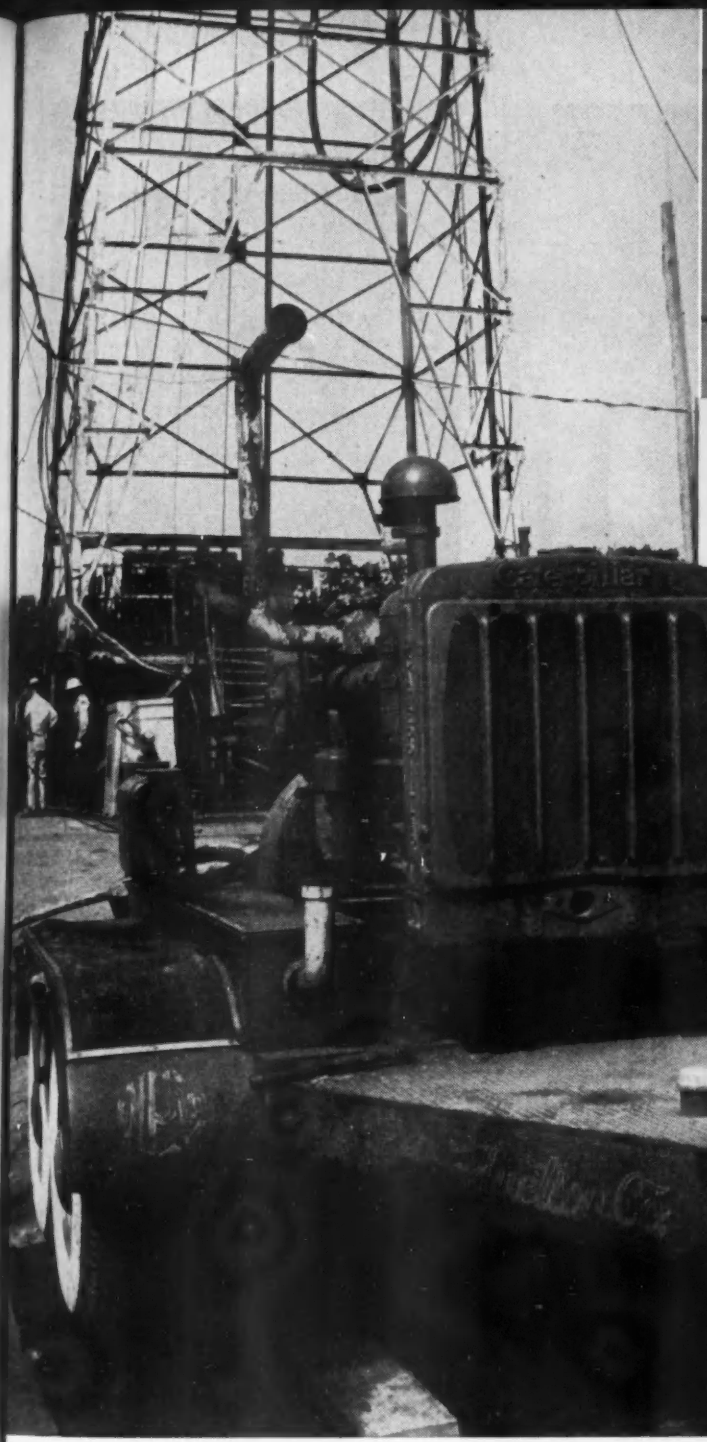
The unit then was moved 49 miles to the Kimball area and rigged up on the Evertson 1. Seven-inch casing was set at 252 feet with 40 sacks. A 4¾-inch hole was drilled to 6229 feet with 109 feet of intermittent coring. Final total depth was 6514 feet. Electric logs were run and the hole was abandoned.

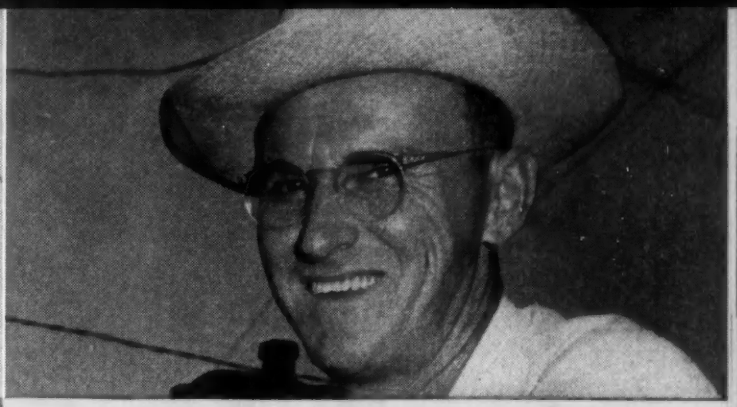
The fourth move was to the Lexington area, a distance of 246 miles, where the crew rigged up on the George Maloley 1 for a stratigraphic test. The 7-inch surface pipe was set at 527 feet and cemented with 80 sacks. A 4¾-inch hole was drilled to 2502 feet, and from this point was cored continuously for an additional 1324 feet.

Summary. It is not the contention that the small bore drilling will entirely replace the heavy rigs for wildcat drilling, but it is felt that many hundreds of thousands of dollars may be saved annually with use of these tools in exploratory drilling.

In considering the fact that 10 or 15 years was required to scale the drilling operations from 20-inch surface pipe to 10¾-inch, drill stem from 6⅝ inches to 4½ inches and 12¼-inch hole to 8¾-inch for the 7-inch casing in the normal 7000-foot hole, what little has been done in this experiment to promote the use of the small bore drilling rig will make much of an impression on the average layman in the oil industry.

Perhaps in the next few years, the drilling of 3-inch bore holes and smaller to depths of 10,000 feet will be as common as popcorn in a theater.





"...we set them up, hook up three wires, and have steady electric power"

So says E. S. Parker, drilling superintendent of West Production Co., Houston, Texas, about his Cat* D4400 Electric Set. It develops 20 KW for rig lighting and two-way radio communication between the rig and the main office. And it's tough, rugged, dependable—working 24 hours a day every day of the month when drilling is in progress. The electric set now has well over 14,000 hours on it!

There are 12 sizes of engines and electric sets, ranging up to 500 HP and 315 KW. They're simple in design and construction, portable, and economical. Leading manufacturers can supply these engines to power their oilfield equipment.

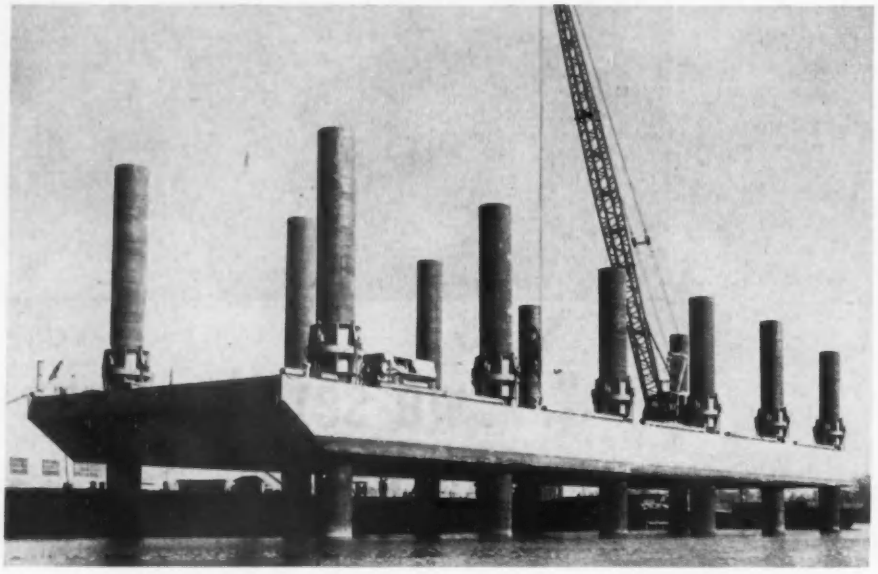
Your nearby Caterpillar Dealer can show you how these oilfield engines can earn extra profit on your rig or pumping job. Call him—let him show you proof of performance.

Caterpillar Tractor Co., Peoria, Illinois.

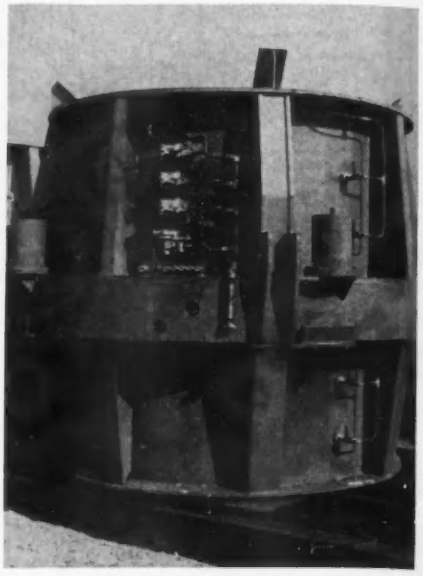
CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks—®

NAME THE DATE... YOUR DEALER WILL DEMONSTRATE



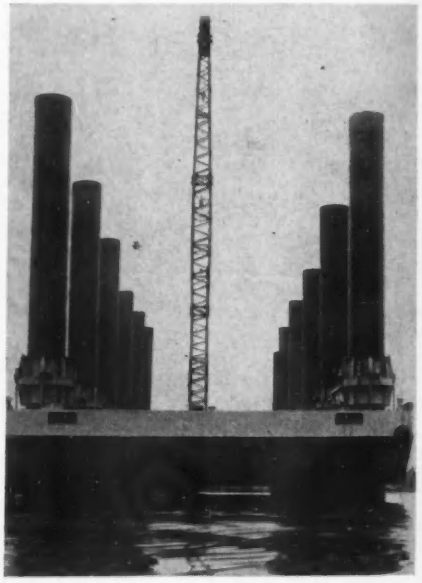
The barge on location after steel stilts have been pile-driven to insure solid footing. Air-operated jacks attached to hull climb 5½ million-pound unit, six inches at a time.



Closeup of jack showing rubber gripper valve arrangement.

Is This the Answer To Offshore Operations?

New dock-barge with built-in jacks can move from one location to another in matter of hours.



Deck space measures 300 feet by 90 feet.

ENGINEERS AND STEEL fabricators have put the simple mechanical principle by which a small lad shinnies himself up a tree trunk to work in a complex jack mechanism and designed around the jack a new steel dock that is rapidly changing the concept of harbor and drilling installations. The unique dock is built simply as a barge, floated to destination, "shinnied" up legs that it carries along, and installed as a permanent steel-strong dock.

Yet in a matter of hours it can pick itself up, hook onto a tug and be towed to a new location.

At destination, with the hull resting on the surface of the water, the 100-foot steel stilts are dropped through the 6-foot-diameter wells—and through the jacks set around the tops of the wells—to tideland or river floor. Then they are pile-driven through the sand to solid footing.

Then the jacks go into action as follows: The top of the jack is anchored to the deck. Both upper and lower halves of the jack are equipped with air-operated rubber grippers, tire-like tubes circling the inside wall between the jack and the caisson. Another set of tubes circles the caisson between upper and lower jack sections. When dock is positioned and caissons are on bedrock, jack is raised six inches above deck level. Air pumped into rubber tubes of lower half causes a firm grasp on the caisson. Next the rubber tubes between the jack sections are inflated, forcing top half up six inches. Tubes in top are then inflated, clamping the upper half to the caisson and holding the barge at that height, while the lower grippers are released and the center tubes deflated. Retraction pulls the lower section upward, where it is again clamped and the operation repeated. Thus, with all jacks working simultaneously, the entire hull climbs six inches at a time.

On the offshore drilling side, extensive testing in the Gulf has convinced engineers this is one of the best solutions yet devised to the problem of mobility—the byword in drilling operations and a major bottleneck to cutting costs of expensive tideland operations.

Keeping the basic caisson-and-air jack principle, the barge (300 feet long by 90 feet wide) lends itself to fabrication to any size and dimension to serve a driller's particular requirements. Too, since loads on a drilling barge are not as extreme as on a harbor dock, much of the interior ribbing can be eliminated, yet the structure is far stronger than required by the heaviest drilling load. Most of the hull's roomy interior can be utilized, saving premium deck space.

PLAY OUT or PAY OUT

Have it analyzed with 700-reservoir experience....

CORE LABORATORIES, INC. ● IN ALL ACTIVE AREAS

Dallas, Houston, Corpus Christi, Midland, Abilene, San Antonio, Tyler, Wichita Falls, Lubbock, Oklahoma City, Ft. Worth, Great Bend, Shreveport, Lafayette, New Orleans, Natchez, Bakersfield, Denver, Sterling, Worland, Williston, Billings, El Dorado, Farmington, Lovington, Calgary, Edmonton, Venezuela, S. A.

CORE LAB

PETROLEUM RESERVOIR ENGINEERING

The panel, from left: W. M. Bullock, driller for Moran Bros., Inc., at Odessa, Texas; E. B. Robberson, toolpusher for Kerr-McGee Oil Industries, Inc., at Odessa; E. C. Cusenbary, recently a driller, now a toolpusher, for Paine Drilling Company at Graham, Texas . . .

Job Talk Promotes Safety . . . .

EDITOR'S NOTE: *Job safety can be promoted by giving men an opportunity to talk about their jobs, thus reminding themselves of the hazards involved. This safety technique was demonstrated in a panel discussion at the Eighth Annual Drilling Industry Safety Clinic, sponsored by the AAODC at Dallas in May. The discussion had the added value of stressing the work hazards which have most impressed the men exposed to them, and their practical ideas of how accidents can be avoided. WORLD OIL recorded the discussion and offers it here in slightly condensed form.*

E. L. Williams, director of the Texas A. & M. College Engineering Extension Service, was moderator of the panel discussion.

WILLIAMS—Accidents are caused; they don't just happen. Only 2 percent of all the accidents are Acts of God—accidents that can't be prevented. Those are your cyclones, hurricanes, lightning, etc. Ten percent are labeled as mechanical failures, and as we analyze these we find that in about half of them somebody didn't use the device properly; it wasn't properly maintained, they put a cheater on it, or did something that shouldn't have been done. That means that about 88 percent of all accidents are caused by some one person.

Of the three E's of accident prevention, the first is the E in Engineering. I don't see how engineers can do more than they are now doing. They're building the best equipment, the best guards, but still we have accidents. So the engineer can't prevent more than 10 percent. Then there's the E in Enforcement. But you could not hire enough people to enforce all your rules or all the laws. So that leaves only one E we can use, and that's the E in Education. If there is anything we can do to cause people to think, to let them understand more about their jobs, the hazards with which they are working every day, maybe we can help them.

We are going to try a stunt here today that has been used on lots of jobs to get men to understand and appreciate the hazards with which they are working. The job that this panel decided on was "Making a Trip." All right, what are the first operations in making a trip?

BULLOCK—Kick your pump out.

TRUE—Check your slips and your snub lines.

WILLIAMS—Then what, Mr. Hill?

HILL—Well, after your pump's out, go ahead and pick up your kelly. And it's a good idea to grease your rotary bushing before you ever set your slips.

HEATH—Break your kelly off next.

ROBBERSON—Now set your kelly back.

CUSENBARY—I believe the next step would be the derrick man's ascent.

WILLIAMS—All right. We've got the derrick man on the board. Mr. Hill?

HILL—You go ahead and start out with your first stand.

TRUE—Keep on coming out of the hole with your drill pipe. Of course, you've got to latch on to the drill pipe with your elevators. And pull your slip.

WILLIAMS—All right, I've latched

. . . W. A. Heath, driller for Henry Black & Sons at Seminole, Texas; R. W. True, recently a driller, now an engineer, for Big Chief Drilling Company, Oklahoma City; and C. N. (Charley) Hill, driller for Carl B. King Drilling Company of Texas, at Midland, Texas.

. . . . by Pinpointing Hazards

on and I've come out. I just keep doing that until I get all out. What next?

CUSENBARY—After that first stand is latched onto by the floor men it is pulled up through the derrick and then they reset the slips and it is broken off preparing to set it back.

WILLIAMS—All right. What's the next job?

ROBBERSON—Keep coming out.

WILLIAMS—And what do I do after I get it all out?

BULLOCK—Break your bit off.

TRUE—If you are running a float in your drill collars, you have to pull your float and check it to see if it is in working order. Some of them have float pullers and others just feed it out.

CUSENBARY—After the float has been checked and replaced, putting on your new bit would be the next step.

WILLIAMS—All right, I'll stop there. We've gotten out of the hole and the new bit is on. Now, are there any hazards in doing this job so far—any chances to get hurt? We've kicked out the pump, checked our slips and snubs, snubbed the lines, picked up the kelly, broken off the kelly, set the kelly back, and the derrick man has gone to the board. We pulled out the first stand, latched on to the elevators, and we have kept on coming out. We've got it all out, broken off the bit, pulled the float and checked it and put on a new bit. Now, in doing that work, what are some of the hazards involved? A hazard is anything that can cause a man to get hurt or can cause an accident. Give me one hazard, Charley.

HILL—Pulling the slips. You can hurt your back if you don't pull it right.

WILLIAMS—Okay. Is it from an improper stance?

HILL—That's the main thing.

WILLIAMS—Well, is it due to its weight or a slippery floor, or what, if the man hurts his back?

HILL—All of those would cause it.

WILLIAMS—Give me another hazard, Mr. True.

TRUE—If you're breaking out and you break a snub line or something, the tongs will pretty well clean the floor.

WILLIAMS—What will cause that?

TRUE—Faulty, wornout snub lines, wire line worn out, bad clamp.

BULLOCK—Mr. Williams, I think the most dangerous thing right here would be breaking out with one pair of lines.

ROBBERSON—As long as you've got just one snub line and one line, why then you've got a ball and a cathead.

WILLIAMS—All right. What's another hazard in doing this job?

CUSENBARY—As I see it now, all these are preparatory measures toward breaking off the kelly . . . Well, the next hazard I could see there would be from the backup tong. If the lead tong man didn't get them loose fast enough and the driller pulled the rotary in.

WILLIAMS—Lead tong man not getting tongs loose quick enough. All right. Charley?

HILL—We forgot to take the derrick man up.

WILLIAMS—What hazards does the derrick man have?

HILL—Well, there are different things, just according to what companies use. Most of them take them up on the elevators.

WILLIAMS—Is there a hazard in riding the elevators?

HILL—I don't think so.

TRUE—I disagree with him.

WILLIAMS—All right, we could probably take a vote on it and settle it. But I'll just put up here that riding the elevators is hazardous. Is there another hazard there, Mr. True?

TRUE—Well, I think some contractors, probably very few, use a safety belt on the elevator or the bails when the derrick men go up, and then they take the safety belt off and jump

on the board. This getting on the board is dangerous. If a man slips . . .

ROBBERSON—He can step off and and miss the board, too.

WILLIAMS—All right. Do you have another hazard we can put up here in doing this particular job, Mr. Cusenbary?

CUSENBARY—Yes, sir, I sure do. In the event that the derrick man climbs the ladder, if the ladder and other equipment isn't in good shape, he's liable to fall.

WILLIAMS—All right, we've got the derrick man up there. We've had him taking chances on the ladder, we've had him taking chances riding the elevator up, we've had him taking chances when he stepped off. What's another hazard?

HEATH—One hazard would be in not making sure that your elevators are properly latched before clutching your rig.

WILLIAMS—In resetting or setting back, what hazard is there?

TRUE—Well, there's a possibility that after the stand is broken out to be set back, the motor man who sets the stand back, if he isn't watching himself, he'll probably set it on his foot or something. And also the man in the derrick—if he doesn't unlatch at the proper time or if he doesn't get his hand out of the way while the blocks are on the stand, there's a possibility of him getting his hand mashed up in the derrick.

WILLIAMS—All right, now I want a description of accidents you men have seen happening while doing this work. I want the description of what happened, of how badly the man was hurt or the equipment damaged.

BULLOCK—We're going back in the hole?

WILLIAMS—No, we haven't started in yet.

BULLOCK—Well, a wet floor.

WILLIAMS—All right, how badly have you seen a man hurt on a wet floor?

BULLOCK—Well, I've seen them slip and fall and skin themselves up pretty bad, but nothing serious.

WILLIAMS—What's the most serious slip-fall accident you've seen happen while doing this job, Mr. Robberson?

ROBBERSON—One man got an arm broken.

WILLIAMS—How long was that man out of work with the broken arm, Mr. Robberson? What would you guess? Three months?

ROBBERSON—About 4½ months. It chipped the bone off. They had to put screws on it and it wouldn't grow back.

WILLIAMS—All right, do you think that man received full compensation—that he was just as far ahead at the end of that four months as he would have been if he had been working?

ROBBERSON—He lost a lot of money—an awful lot of money.

WILLIAMS—He lost a LOT of money. You'll notice here, gentlemen, that I'm going to try to stay away from your company costs. You employers know what it costs you; you're paying the insurance. But do your men know what it costs them? This man was off about four months. Would you guess how much he was out of pocket, Mr. Hill?

HILL—Quite a bit. I was off 4½ months with a broken leg. We didn't mention pulling our drill collars a while ago. That's the way I got mine.

WILLIAMS—How much money were you out? A couple of thousand dollars?

HILL—I guess it would be that much. You get your compensation and your insurance that the company has, and then you get a lump settlement.

WILLIAMS—Does that pay all of it?

HILL—No, that doesn't pay all of it. It pays your doctor bills. It gives you about $50 a week until you get your lump sum, but that's not like working.

WILLIAMS—Is that leg of yours as good as it was before you broke it?

HILL—I get around, but it's crooked.

WILLIAMS—Can you tell us about an accident that happened in this particular job, Mr. True?

TRUE—One that might be mentioned was in breaking off the kelly right at the start of the trip. They were pulling the kelly over, and the rope broke on the cathead. The kelly flew back and hit the driller. It mashed a couple of ribs, and I believe he's still having trouble with the situation.

WILLIAMS—Have you thought of an actual case of somebody's having been hurt doing this work, Mr. Bullock?

BULLOCK—Yes, sir. Back there on your last stand of drill collars, I recall a crew left the safety clamps on and pulled the stand on up in the derrick to break the bit off, and the clamps slid down the drill collars and broke a fellow's arm.

WILLIAMS—Give us another accident, Mr. Cusenbary?

CUSENBARY—As I stated a while ago, when a driller pulls the rotary table in before the lead tong man gets his tongs off, it's bad. Once when I was roughnecking that caused me to swallow half a package of Beechnut tobacco. When the backup tong was coming around and biting—they bite backwards—the drill pipe is rotated, the tongs come around, and caught the back of a man.

WILLIAMS—Ever known a man having his back broken from that?

CUSENBARY—No, sir, I haven't ever known of anybody actually being—well, yes, I do, too. I know a man that was thrown over in the rat hole by that same operation.

WILLIAMS—All right. Now, in this one job of making a trip we have every type of an accident. So this must be a pretty hazardous occupation. But as I said at the beginning, these accidents are caused. Now, how can we keep from having a man fall and break his ribs from a slippery floor?

CUSENBARY—The way to do that would be to keep the floor clean.

WILLIAMS—Is that impossible, Mr. Hill?

HILL—Well, in some cases it would be nearly impossible. You'd spend half your time washing. We keep rubber coating on our floor.

WILLIAMS—Now this man was hurt by the drill collars sliding down the pipe. What can we do to prevent an accident like that, Mr. Bullock?

BULLOCK—Always remove the safety clamps.

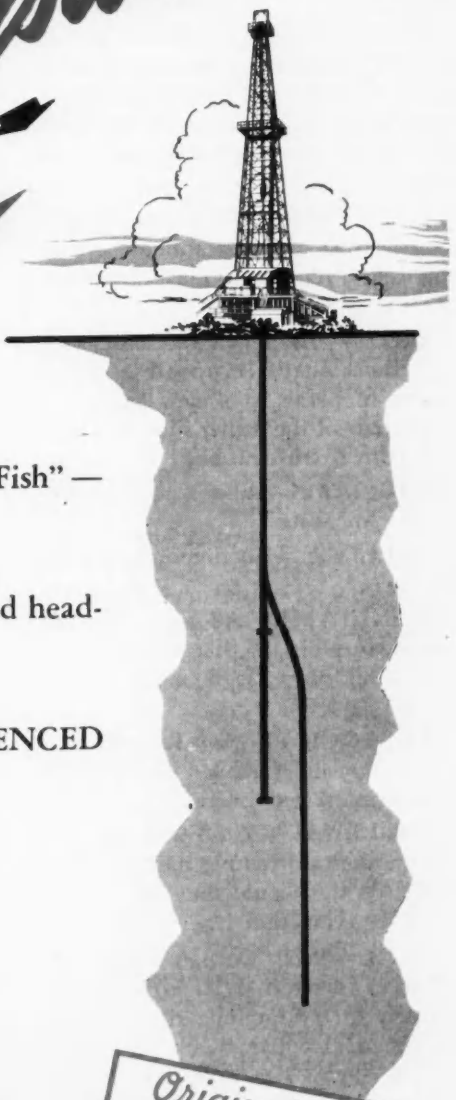
WILLIAMS—All right, and how are we going to keep those tongs from swinging, Mr. Robberson?

ROBBERSON—There's no way to keep them from swinging.

WILLIAMS—All right, but how

Can't Fish It?

Eastman Has the Answer . . .



REMEMBER — When you can't recover your "Fish" — CALL EASTMAN!

Sidetracking is our business. We will save you time and headaches if you will let us solve your problem.

Eastman's combination of proven tools plus EXPERIENCED ENGINEERS assure you the best sidetrack job.

Eastman

22 OFFICES FOR YOUR CONVENIENCE
CONSULT YOUR TELEPHONE DIRECTORY

SEE OUR CATALOG IN THE COMPOSITE CATALOG

EASTMAN OIL WELL SURVEY CO.
LONG BEACH DENVER HOUSTON

Originators of Controlled Directional Drilling Service
Pioneers of Oil-Well Surveying

Export Sales and Service
EASTMAN INTERNATIONAL COMPANY ★ P. O. Box 1500 • Denver, Colorado

are we going to keep a man from getting hurt?

ROBBERSON—We can use a snub line, coming out. Speaking of the backup tongs, they bite both ways.

WILLIAMS—And what can we do about those wornout snub lines, Mr. Cusenbary?

CUSENBARY—See some supply hands.

WILLIAMS—In other words, replace them. All right. What's another thing that can be done to prevent these accidents from happening, Mr. True? Give me anything now that will keep these accidents from happening while we're on this job.

TRUE—Well, the general idea is to take precautions. You can work pretty rapidly and still have everybody on their toes. But if the men get lax, there's a greater chance to get hurt.

WILLIAMS—All right. Now, I took it from the first statement that you said every man must know his job and place?

TRUE—In a general sense, yes. Sometimes that's impossible when you're breaking in a new man, but that's part of the driller's job to watch him with extra caution.

WILLIAMS—What's another preventive measure?

BULLOCK—Good morale among the men.

WILLIAMS—All right. If each man knows his job, likes his job, and knows his place, is he liable to get hurt?

BULLOCK—I'd say he wasn't as apt to get hurt as he would if he wasn't interested in his work.

WILLIAMS—Okay. Can you give me another preventive measure, Mr. Hill? What would have kept you from breaking that leg?

HILL—Well, we had started out using nine-inch drill collars and wanted to try latching the elevators on the drill collars while they were on the floor. The dollyhead nubbin got caught on the swivel and picked it up and cleared the rotary table and fell on through the floor. The best thing to do is just go ahead and latch on the drill collars while they are standing in the derrick.

WILLIAMS—In other words, follow correct procedure. Will the correct procedure be the safe way?

HILL—There's none of them safe. A man can get hurt while doing the right thing.

WILLIAMS—Does hurry cause lots of accidents?

HILL—Part of them.

WILLIAMS—All right, a preventive measure is, don't hurry unnecessarily. You men have to move fast, but is there a difference between a sure, safe moment and a hurried movement? All right, move sure and safely. Now then, who is going to prevent these accidents? Who can see that these preventive measures are carried out so that these accidents will not happen from these hazards while you are doing this operation?

TRUE—Each individual.

WILLIAMS—Who is the man who is supposed to know that each individual does know what he is doing on this rig?

TRUE—The driller.

WILLIAMS—Is there anyone besides each workman and the driller to prevent these accidents?

TRUE—The contractor. I would say he can talk safety and keep the safety word passing among the men so that the men will talk it among one another.

WILLIAMS—All right. Now then, the contractor has certain responsibilities for providing the right equipment and also carrying out and promoting a safety program. That the contractor's responsibility, Mr. True?

TRUE—Well, yes it is, just like your chain of command anywhere else. The contractor or the office force, they are the first ones to give you the equipment and then down through the chain of command—the drilling superintendent, toolpusher, the driller, and then the individual.

WILLIAMS—Have you ever known of an instance where the contractor furnished you some good equipment and when it got out there somebody took off the safety device? Somebody said this thing is in the way? Has that ever happened on the job, Mr. Heath?

HEATH—Yes, sir, such as a safety throwout on your cathead.

WILLIAMS—All right, so it still is up to the driller to make sure that each man knows his job and how to do it correctly. Would you say that is correct, Mr. Cusenbary? Are you a driller?

CUSENBARY—Well, I have been a reasonable facsimile. I would say that the chain of command coming down from your contractor—who, of course, doesn't have time to get around to the rigs too often—would be your supervisory personnel, your drilling superintendent, then your toolpusher, and then on down to your driller.

WILLIAMS—Right on this job, while you are doing this particular job, the contractor is liable to be miles away, isn't he?

CUSENBARY—That's very true.

WILLIAMS—How about the superintendent?

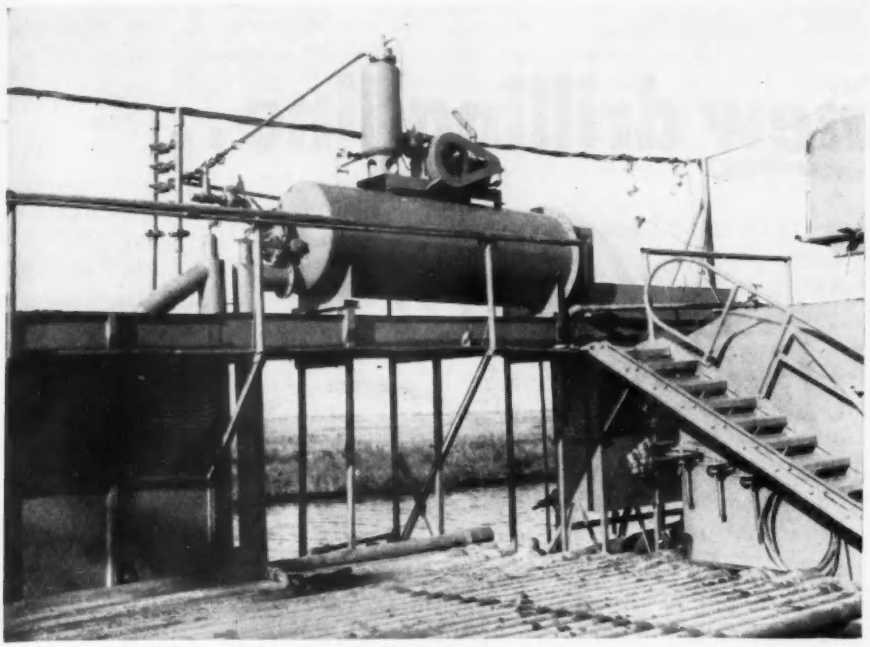
CUSENBARY—Sometimes you can't find him, either.

WILLIAMS—So that pins it on who?

CUSENBARY—Well, it all works down to the driller because he's the one there at the time.

WILLIAMS—Okay. What I'm trying to get over here is that you can hire all the safety engineers you want to, all the safety directors you want to, and the contractor can provide the best equipment he can get, but the immediate supervisor, regardless of his title—farm boss, gang pusher, toolpusher, driller—he's the man who's going to prevent the accidents, and nobody else. But even though this driller is doing a good job, it still comes back to every individual on the drilling crew to carry out the job as he has been trained to carry it out.

Now then . . . this particular method demonstrated here of analyzing jobs and finding hazards was developed for the purpose of causing men to think. Ask men what they do on their jobs and they'll tell you. They'll tell you because they know, they live there. And you'll notice that I'm not talking to employes about their employers' insurance cost. The employe in my experience doesn't give a damn about your insurance cost, but every human being thinks first about his own belly and his own pay envelope and his own family. So in talking to employes, let's find and describe the accident from the standpoint of their inconvenience. Let them tell you. This method answers that third E in Education by letting them educate themselves.



The new cascade-vacuum type mud degasser picks up gas containing mud from mud trough. After mud is cascaded over a moving baffle system and is subjected to as much as 25 inches of mercury vacuum, mud is discharged gas-free.

New Vacuum-Type Degasser Reduces Deep Drilling Hazards

Here's how it works and results of operations in two critical areas—Gulf Coast and New Mexico.

By R. W. (WOODY) ERWIN
Vice President and Manager, Salt Water Control, Inc.

A NEW CASCADE-VACUUM type degasser with a 25-inch mercury rating, controls and balances mud weight to prevent the shift from lost circulation to blowout conditions, normally a deep drilling hazard. Its use has already saved several deep holes.

The new degasser can be installed on either the up or down side of the shale shaker to handle any abnormal volumes of mud and fibrous materials without clogging.

The principle is simple. The mud from the well is cascaded over baffles and subjected to high vacuum to draw off entrained gases. The efficiency of this degasser in removing gas from a mud system automatically and continuously is very high.

Summed up, the degasser offers the following advantages to operators confronted with abnormal drilling conditions because:

- Valuable rig time can be saved.
- Mud and chemical bills are reduced.
- Total mud is degassed as it comes out of well.
- Smaller mud systems are permissible.
- Mud conditioning time is cut to a minimum.
- More accurate mud logging is possible.
- Fluffy and high viscosity mud conditions are minimized.
- Degasser performs as a mud conditioner and mixer.
- Balanced mud weights are maintained.
- The degasser fits compactly over mud ditch, conserving valuable floor space on barge rigs.

This device has proved beneficial in controlling close balance conditions in a recently-drilled New Mexico well. At the same time, it has proved particularly adaptable to Gulf Coast high-pressure zones.

This is how it has operated in two critical areas:

• **Gulf Coast.** Successful completions had never been accomplished in the lowest penetrated zones, for upon reaching objective zones, holes were lost, blowouts occurred and backoffs necessitated. In one well, an abnormal pressure condition led to enforced mud weight increases and maintenance so pressures could be controlled to prevent bleeding, cutting or controlling losses to upper zones.

Drilling ahead at 11,505 feet, a close balance condition was confronted requiring a 15 pounds per gallon mud. Ounces in excess of this weight could lead to uncontrolled condition—lost returns. At 14.5 pounds per gallon, the well started kicking. When mud was built up to 15.5, an excessive column weight resulted, leading to formation breakdown and lost circulation. Drill pipe stuck. The mud was reduced to 11.4 pounds, and after a lengthy washing over period, 10,274 feet was reached.

The mud weight was increased to 12.0 because the gas was increasing after each trip. A cut was made at 10,218. The mud, badly gas-cut, did not register on the mud balance. After increasing the weight to 13.0, drill pipe was pulled and a new bit was run. The hole was reamed and conditioned to the top of the fish at 10,218 feet. Then mud weight was raised to 13.3 pounds.

A trip was made into the hole with wash pipe, washing over to 10,353 feet, where gas increased so that preventer had to be closed. Fifteen hours were required to work pipe with preventer closed. The mud and gas was discharged through three two-inch lines. The mud weight was 15.5

A mighty *new* drilling line..

J&L STEEL Spring-Center

The new J&L SPRING-CENTER DRILLING LINE is one of those revolutionary improvements you wonder why some one didn't think of long ago.

The tightly coiled steel spring has nowhere to go. Over the sheaves and around the drum it stays right there like the hydraulic cushion in a shock absorber. Under surges of weight and pressure that might well crush any ordinary drilling line, this J&L line with the new SPRING-CENTER delivers the ton miles unharmed.

Extensive field tests on drilling wells have amply confirmed the remarkable endurance and dependability we expected of J&L SPRING-CENTER.

You'll want to know more, of course. Please 'phone your J&L supply store NOW!

PESA

JONES & LAUGHLIN STEEL CORPORATION
SUPPLY DIVISION

J&L STEEL

General Offices: **TULSA, OKLAHOMA**

88 STORES • 19 OFFICES • 9 RESIDENT SALESMEN

EXPORT: 405 Lexington Ave., New York, N. Y., U. S. A.

pounds in, and 15.3 pounds out when circulation was lost again.

After pulling out of the hole, 300 barrels of 13.5 mud were required to fill hole. Ran an overshot in hole and a bridge was hit just below bottom of 10¾-inch surface pipe, set at 1747 feet. Pulled overshot and ran bit and one drill collar. At 5000 feet, a plug was encountered and reaming continued. The mud weight was kept at 15.0 going in, and was continuously gas-cut coming out, while reaming and washing to 8461 feet. Mud was circulated and conditioned for 24 hours. After losing mud steadily, complete returns were lost. Total loss was about 750 barrels. After pulling out and changing bits, went back to bottom of surface pipe.

New 15.0 pound mud was mixed, 750 barrels were pumped into reserve tank and 400 barrels into pits. The mud was kept at 15.0 pounds going in the hole, and it came out highly gas-cut, while washing and reaming to top of fish at 10,218 feet.

After 12 hours of circulating, the mud weight at the flow line finally came up to 14.8 pounds. The bit was pulled out and 7⅝-inch casing was run and set at 10,020 feet without further trouble.

With this close balance condition, the operator was "walking on thin ice" constantly. An abandoned hole was averted in presence of unstable mud balance. By the utilization of the degasser, gas-cut mud was handled constantly without trouble. Normal muds were put back into the hole and controlled until the fish was contacted.

• **New Mexico.** The well was drilled in a close balance province, where high pressure and weak formations are present. Conventional methods of degassing mud failed to prevent an overbalanced system.

The new degasser successfully controlled a condition where a 13 pound mud was the minimum to prevent blowout and the maximum to prevent lost circulation.

When the mud built up to 13.3 pounds, some 400 barrels of mud were lost to the formation. The mud was then restored to 13.0 pounds and began cutting 2.0 pounds per gallon. A striking example of the degasser's effectiveness was on a trip when the 13.0 pound mud was cut back to 8.0 pounds per gallon. The degasser continuously restored it back to 13 pounds.

Drilling is currently proceeding with the mud cutting constantly, but operations are normal as the degasser continues to remove the gas as the mud comes from the well, keeping the well under control by return of normal gas-free mud.

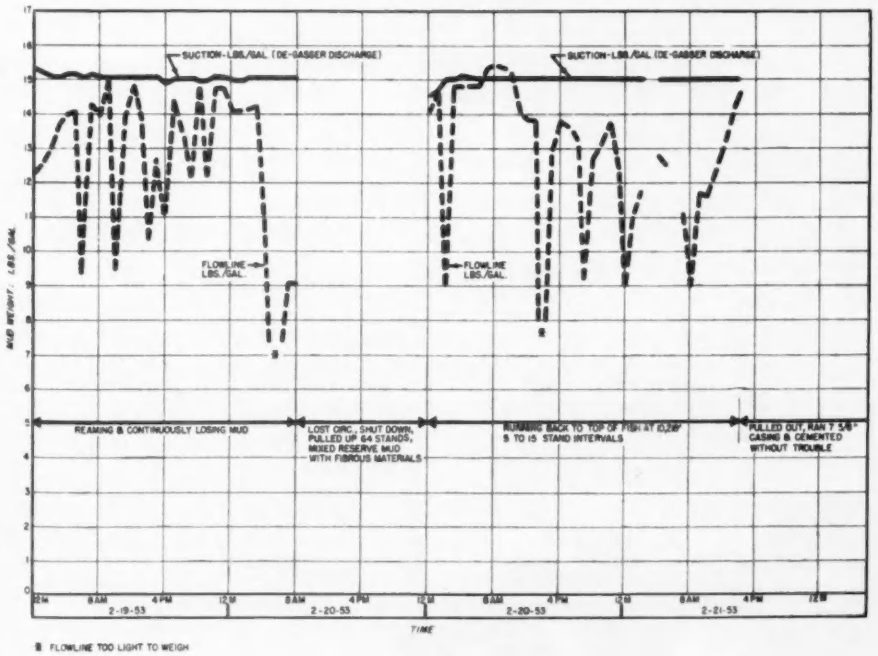

SUCTION - LBS./GAL. (DE-GASSER DISCHARGE)
FLOWLINE LBS./GAL.
REAMING & CONTINUOUSLY LOSING MUD
LOST CIRC., SHUT DOWN, PULLED UP 64 STANDS, MIXED RESERVE MUD WITH FIBROUS MATERIALS
RUNNING BACK TO TOP OF FISH AT 10,218' 9 TO 15 STAND INTERVALS
PULLED OUT, RAN 7 5/8" CASING & CEMENTED WITHOUT TROUBLE
2-19-53
2-20-53
2-20-53
2-21-53
TIME
* FLOWLINE TOO LIGHT TO WEIGH

FIGURE 1.
Performance of vacuum mud degasser in lost circulation problem, Richardson and Bass 25-E, Morgan City, La.

Problem of Pressure Control. If wells are to be drilled in abnormal high pressure areas where weak formations are present, troubles are ahead. Such conditions as losing mud to the formations after it has been weighted to control abnormal pressures, or to upper zones already penetrated, are common to the Gulf Coast. Everyone recognizes how disastrous this can be.

Entrained Gases. It is extremely important that the return mud to be pumped back in the hole be free of entrained gases. When the presence of gas reduces the safety factor of mud weight to zero, or even to a negative value—blowouts result causing enormous amounts of damage to reserves and property.

When gas is encountered in the course of drilling gas-bearing strata, gas becomes entrained in the mud as microscopic bubbles, by absorption or adsorption on solid particles, and to some extent by solution in water.

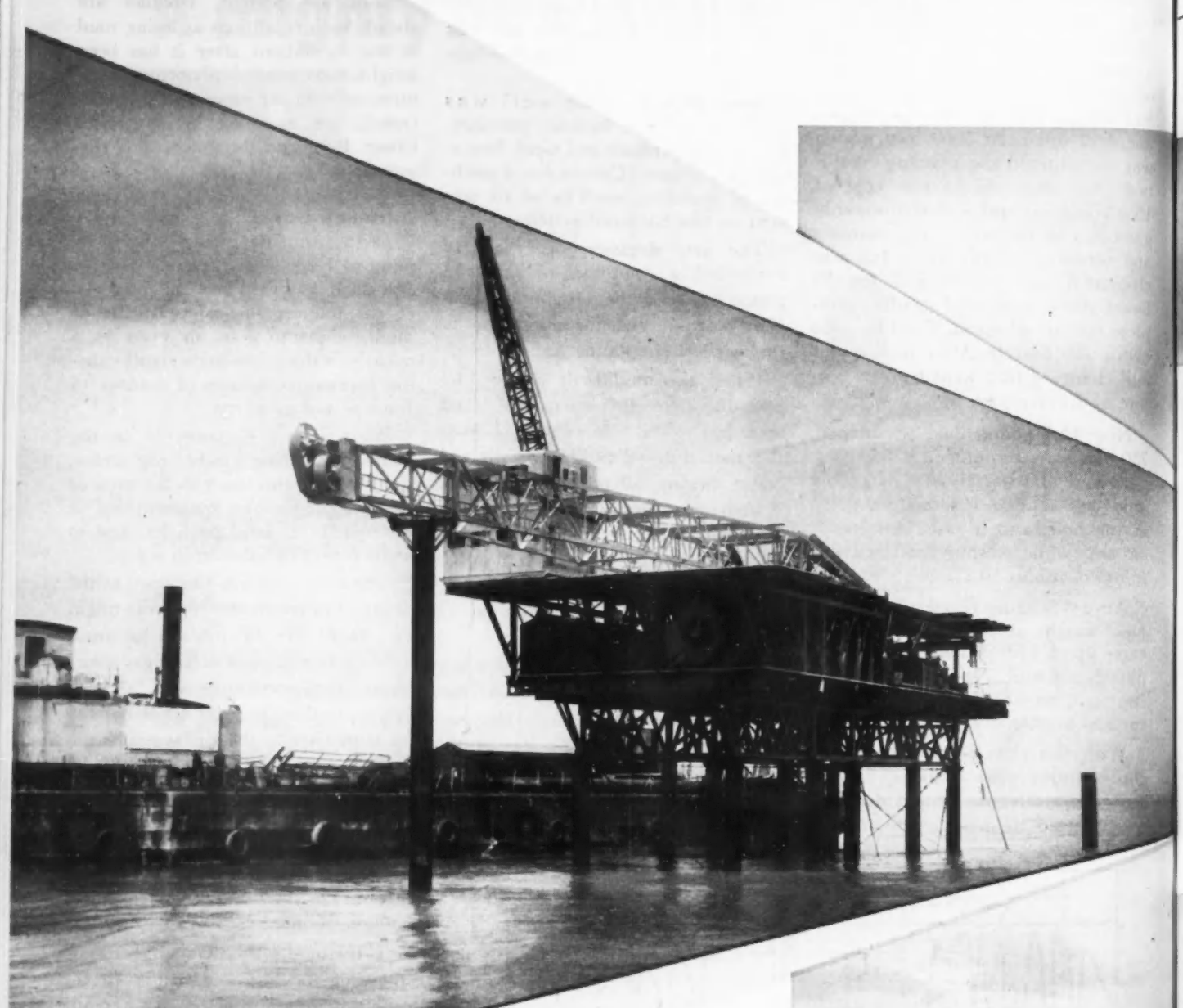
The volume of gas entrained at the point of entry in the reservoir might be small due to intense pressures tending to compress it. The gas sometimes exists as a condensate. The gas is dispersed in the mud as the column of mud rises to the surface. The gas bubbles begin to expand with the decrease in column pressure. As the gases expand and occupy more space, the hydrostatic head decreases, allowing more gas to enter the bore hole below. The more the gas expands, the lighter the mud becomes.

If the mud is thin enough to release most of the entrained gases to the atmosphere upon its arrival at the surface, the problem is not too troublesome.

The degasser will effectively remove gas from high-viscosity and high-gel strength muds, and also from heavyweight muds containing lost circulation, fibrous material or salt. These muds hold the gas more tenaciously than thinner or lighter muds. Gas problems usually arise in muds of this nature.

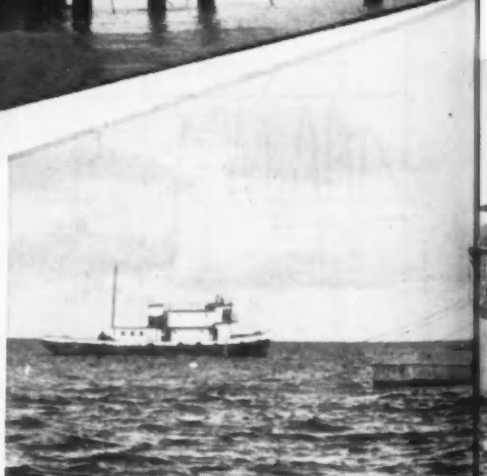
Adding Weighting Material. If entrained gases are not removed it becomes necessary to add weight material. This calls for additional viscosity building materials to hold

SPECIAL APPLICATIONS FOR..



LEE C.

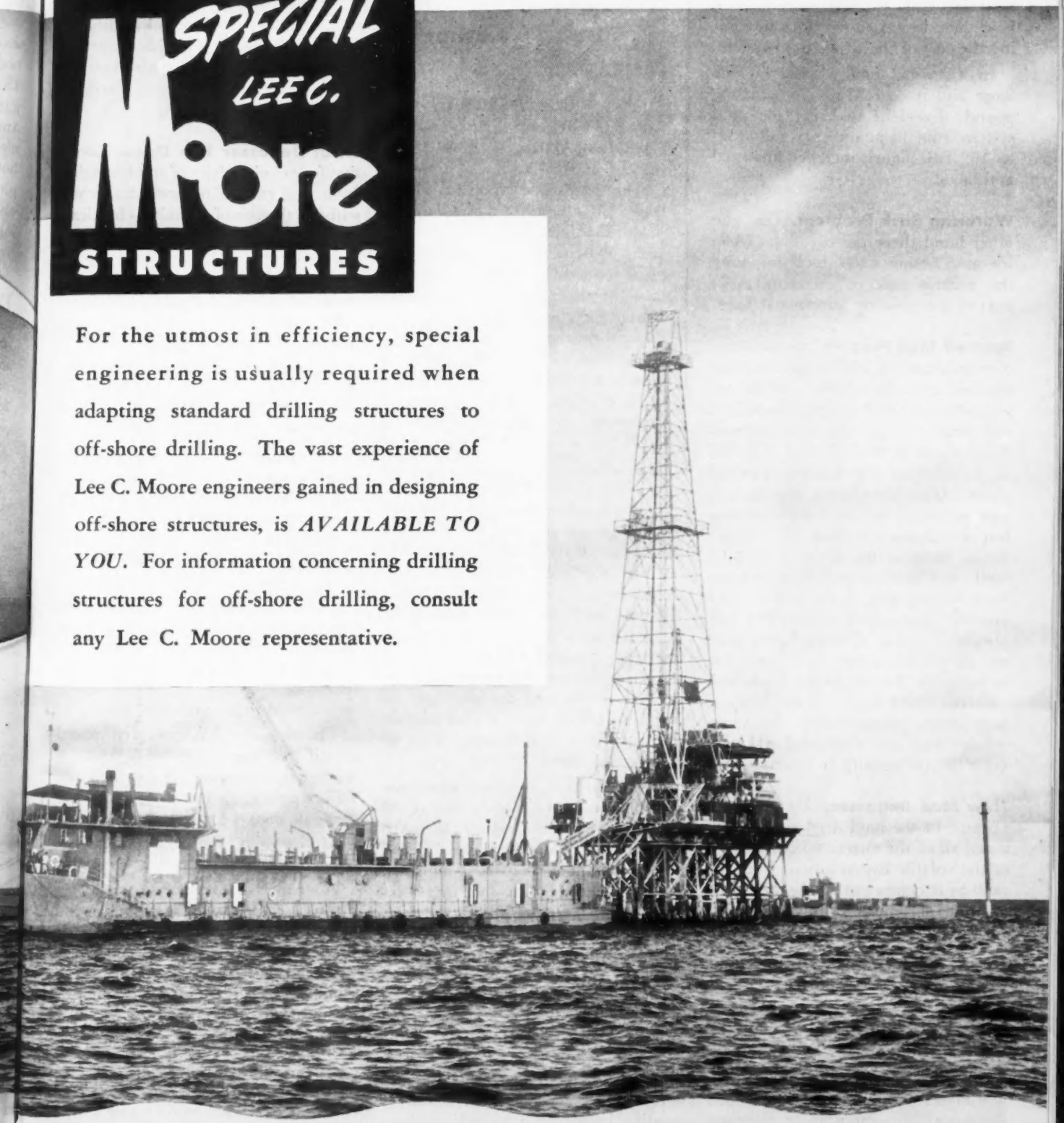
Moore



EFFICIENT OFF-SHORE DRILLING

SPECIAL LEE C. Moore STRUCTURES

For the utmost in efficiency, special engineering is usually required when adapting standard drilling structures to off-shore drilling. The vast experience of Lee C. Moore engineers gained in designing off-shore structures, is *AVAILABLE TO YOU.* For information concerning drilling structures for off-shore drilling, consult any Lee C. Moore representative.



LEE C. MOORE CORPORATION TULSA • DALLAS • HOUSTON • MIDLAND • SHREVEPORT
WICHITA • CENTRALIA • PITTSBURGH • Export Office — Room 624, International Bldg., 630 Fifth Ave., New York 20, N. Y.

weighting materials in suspension. The system becomes progressively more expensive with each new additive. This can amount to several thousand dollars in one day or can be a consistent requirement which is extremely expensive because weighting materials call for allied chemicals to hold them in suspension, thus increasing the cost of the whole mud system.

In a normal mud system on one large rig, it cost $3500 to add one pound of weight to bring the mud system from 15 pounds per gallon up to 16. This figure included material and labor.

Watering Back Problem. On the other hand there are occasions when the mud becomes too thick, imposing the tedious task of throwing away part of the mud or watering it back.

Spotted Mud Problem. Some blowouts and cases of lost circulation have resulted from an uneven addition of weighting material which causes light and heavy streaks in mud systems. An example of this is shown at 8 AM of 2-20-53 on the accompanying chart. After circulation was lost, it was necessary to shut down to mix lost circulation material in reserve tanks. Starting up again, 15 pound mud was maintained. The returns were coming out of the well at 15.4 pounds. This abnormal weight was obviously a slug of extra heavy mud not thoroughly mixed. It is impossible to calculate the weight of a graduated gas containing mud column, because such muds pumped into the wells, compressing the entrained gas, become proportionally heavier.

New Mud Degasser. The primary purpose of the mud degasser is to remove all of the entrained gas and all of the volatile hydrocarbons from the mud as it comes out of the well. The degasser accomplishes this as follows:

- Exposes all the moving surface possible within economical limits of design.
- Subjects the mud to sufficient vacuum to pull off all mechanically entrained gases.
- Places liquid volatiles in mud under sub-atmospheric pressures to cause evaporation and promote more efficient removal from the mud.

About the Author

R. W. (WOODY) ERWIN, a native of Oklahoma, was graduated from Oklahoma A. & M. College in 1934 with a B.S. degree in chemical engineering. He began his career in a gasoline plant and later was five years with National Tank Company. He is responsible for the development of the horizontal emulsion treater and closed-type salt water disposal system. He joined Sid W. Richardson 13 years ago and is now vice president and manager of Salt Water Control, Inc., a Richardson development company.

The degasser consists of a welded pressure vessel 3 feet in diameter and about 10 feet long. The vessel is set horizontally astride the mud trough or at a point between the mud manifold and the conditioning pits. Gas-cut mud is picked up by vacuum from the sand trap or sump. The mud is pulled into the top position of the degasser where it is cascaded over an involved baffling system. This spreads the mud in a thin moving sheet of considerable area.

Entrained and dissolved gases are pulled out when subjected to 8 or 10 inches of vacuum; however, as much as 25 inches of mercury vacuum can be obtained in this system if required. Due to high vacuum and well temperature of the mud any highly volatile liquid hydrocarbons, such as distillates, will be vaporized and flashed. From here the degassed mud passes to the mud tanks or pits to be picked up by mud pumps for return to drilling well.

Gas Detector. The degasser also serves as a gas detector. A direct reading meter or a recording chart may be incorporated to indicate presence and volumes of gases entrained. The high sensitiveness of hydrocarbon measuring devices used in mud logging makes it very desirable, if possible, to remove all traces of methane and lighter hydrocarbons from the mud before it is returned to the well, so a clean mud is available for logging purposes.

The advantage is that new gas shows indicated would obviously be from well bore. This avoids uncertain correction factors that must now be used where total degassing facilities are unavailable.

What Degasser Has Done. Excessive funnel viscosities of muds coming from well can be reduced drastically without the use of thinning chemicals or water when pulled through this degasser. This is an important application, especially for lime-base mud systems.

Funnel viscosities, on mud coming out of wells, are being reduced as much as 15 to 40 seconds, where viscosities are extremely high. Sixty to 70-seconds muds can be cut back to 50 seconds or normal viscosity.

The degasser has been used effectively as a mixer for dispersing chemicals in a mud system, where chemicals are added just ahead of it.

Improper dispersement of chemical additives in lime-base muds due to carelessness or emergency, could result in solidification, or excessively thick muds. Extensive degasser usage shows that the funnel viscosity is lowered and holds consistently on all lime-base systems in which muds would tend to set up.

The degasser has not been tested on oil base muds. However, there is no apparent reason why it can not show application on oil systems, because of the type of oils used.

Mud can be degassed as it flows from the well.

A smaller mud system is possible—a considerable saving. A standby mud system can quickly reuse the degassed mud. Lost time is minimized in conditioning mud. Gaseous fluffiness is eliminated from muds. This enables the mud to be handled more easily by pumps.

ACKNOWLEDGMENT

The author acknowledges the encouragement and sponsorship of the following in the development of the degasser: C. E. (Skinny) Ratcliff, division drilling superintendent, Richardson and Bass, New Orleans; M. C. Fontenot, division production superintendent, Richardson and Bass, New Orleans, and J. E. Hill, vice president, Richardson and Bass, Fort Worth.

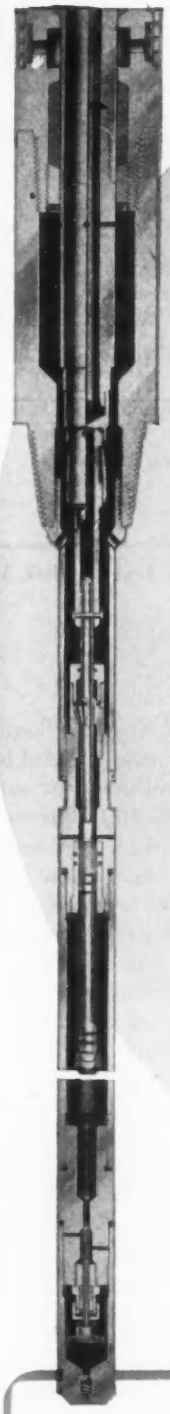
PROVED...

...in THREE YEARS of Successful Operation

The JOHNSTON Reservoir Fluid Sampler

● **The Johnston Reservoir Sampler secures a representative sample of reservoir fluid for laboratory analysis (1300 cc's) providing the reservoir engineer with data as to fluid characteristics and possible reservoir behavior weeks . . . even months . . . in advance of conventional methods. This service is available at a small extra cost WITH EVERY JOHNSTON TEST.**

A copy of Treatise covering full details of this product will be sent you upon request.



Sampler Attached to Shut-in Pressure Valve in Testing Assembly.

Sampler Removed from Testing String as Shipped to Laboratory with Transfer Head.

JOHNSTON TESTERS, INC.

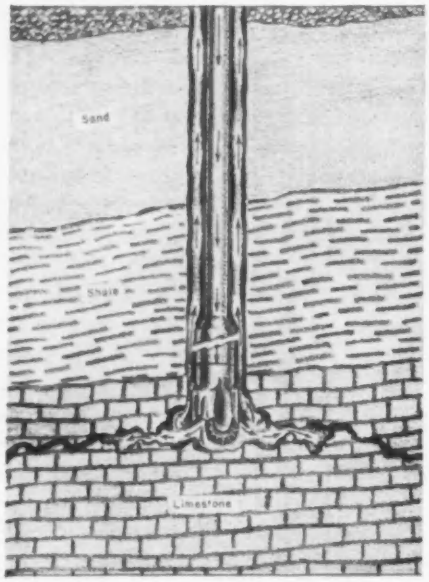
POST OFFICE BOX 165 **HOUSTON, TEXAS**

FORMATION AND CASING TESTING — JOHNSTON

EXPORT DIVISION: 3035 Andrita St., Los Angeles 65, California

SERVICE BRANCHES IN ALL ACTIVE AREAS

There's a Johnston Service Representative Near You



Artist's conception of a formation split.

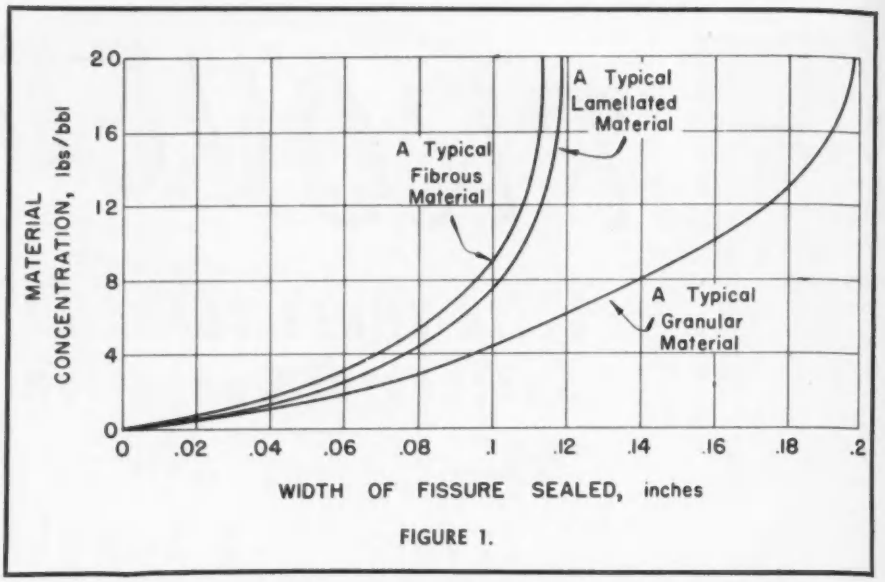


FIGURE 1.

Performance of lost circulation materials in sealing fissures. (After Howard & Scott, AIME, 192, p. 177).

Procedures to Be Used in Fighting Lost Circulation

Anticipate zone and pressure problems ahead of drilling. Here are the remedies . . .

By J. M. BUGBEE
Shell Oil Company, Houston

Discussion of Procedures. When the analysis of the lost circulation problem at a well location has proceeded through the review of the nature of the zone and the pressure conditions, a procedure or sequence of procedures best suited to the problem should be selected.

SPECIAL DRILLING METHODS. There is no way to successfully plug a highly cavernous or open-fissured zone to permit conventional rotary drilling. Examples of this would be the drilling into a cavern like the Carlsbad in New Mexico or an abandoned coal mine, as has happened in Illinois. The method of blind drilling, where water is pumped down the drill pipe to cool the bit and carry the cuttings into the loss zone and no returns are secured at the surface, has been developed for these conditions. An important variation is the use of a floating mud cap when drilling blind. Generally, each such loss zone is cased off after penetration. A recent paper[11] describes these drilling procedures in Saudi Arabia and states that their adoption was the chief cause for the reduction in average drilling time from 120 days to 40 days. As much as 20,000 barrels per day of water are pumped down the drill pipe to cool the bit and carry the cuttings into the loss zone. It is noted that the floating mud-cap method requires careful balancing of formation-fluid pressures with drilling and hydrostatic pressures.

Part 2

Recently, blind drilling in several wells in the Denton field, New Mexico, has successfully penetrated an apparently unpluggable zone occurring below 9500 feet. In one case, the cuttings rather quickly bridged in the loss zone to give partial returns. After some additional drilling, a gel-cement plug was squeezed into the loss zone, and full returns were then secured during the further drilling to some 12,000 feet.

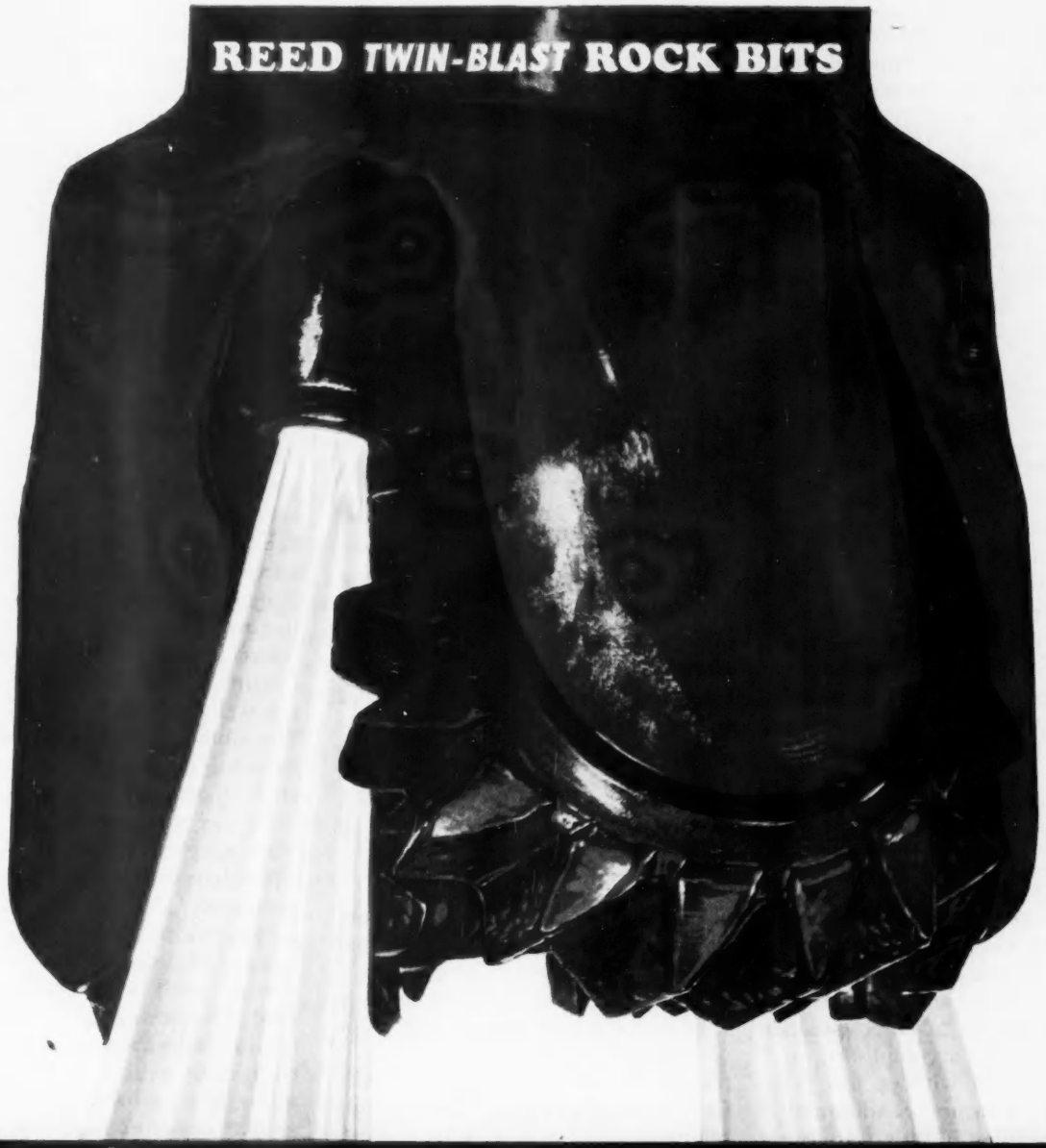
One objection to blind drilling in prospect wells is the absence of formation samples. This can be partially alleviated by the securing of occasional conventional cores.

A related drilling method is to drill under pressure, pumping water or oil down the drill pipe, and permitting the formation fluids to flow from the annulus.

Floating mud-cap drilling has been used in only one field in the U. S., viz., Sunniland, Florida. Seven or eight wells were so drilled and then the use of a low-pressure drilling head with the well flowing was adopted. This latter method has been used where artesian flows have been encountered in shallow beds. The balance between mud densities which cause loss or permit flow can be very close at shallow depths.

Where serious lost circulation occurs

REED *TWIN-BLAST* ROCK BITS



These TWIN BLASTS . . .

. . . blast cuttings from the bottom of the hole!

Slush from the nozzles of a **REED** Twin-Blast Rock Bit blasts against the bottom of the hole and sweeps across at high velocity—carrying cuttings up into the mud stream immediately so cutter teeth can work on new formation.

Result: larger cuttings, faster drilling, more footage per bit and more hole per day, as proved in use on wells throughout the world.

REED ROLLER BIT COMPANY

HOUSTON 1, TEXAS

4149

in formations located above the water table, air drilling[12] has proved very successful for drilling the surface hole.

WAITING PERIODS. In many areas merely allowing a well to stand without pumping seems to permit the formations to adjust themselves to new pressure conditions and to allow full returns after the waiting period. One operator, in a Gulf Coast well, made the following tests[10] of this time factor:

Waiting period, hours	0	1	2	4	8
Casing pressure at which formation took mud, psi	350	275	150	150	525

The effect of waiting is probably most notable in the Gulf Coast but it is also taken advantage of in North Texas and other areas.

The formations frequently strengthen, as regards mud losses, on exposure to mud and the drilling operation. For example, in a well in coastal Louisiana which was drilling with a 15 pound-per-gallon (112.5 pounds per cubic foot) mud below a protective string, a pressure test was made to see whether a 17-pound-per-gallon (112.5 pounds per cubic foot) mud could be circulated; the formation took mud at the imposed pressure. Drilling was then continued with the 15 pound-per-gallon mud for some 200 feet at which time the mud was slowly weighted up to 17 pounds per gallon. This was accomplished and drilling continued without loss. The practice of "pressure conditioning," i.e., the imposition of pump pressures to determine whether higher weight muds can be circulated is not generally deemed helpful because it disregards this increase of strength with exposure.

In a recent well in a coastal Louisiana field, there were five losses while drilling with a 17.0 pound-per-gallon (127.5 pounds per cubic foot) mud below a protective string. The first three were cured by pulling into the shoe and letting the well stand eight hours. The fourth loss did not clear up after a waiting period and a "soft plug," a batch of mud equal to twice the volume of the open hole and loaded with about 15 pounds per barrel of fiber and flake material, was equalized on bottom. Drill pipe was pulled into the casing, the well allowed to stand eight hours, and complete circulation was then secured. The lost-circulation material was not screened out but was circulated and a fifth loss occurred, probably the result of excessive pressure caused by the circulation of this material. A waiting period cured this final loss.

The mechanism by which a waiting period or exposure to the drilling operation strengthens loss zones is obscure. Sometimes a balled-up bit and drill collar are pulled and the cause is, therefore, removed. Generally, however, it is believed that the liquid mud entering fissures becomes dehydrated or thickens with time and serves as a gasket to strengthen the zone. This latter explanation also serves as an explanation of the success of "soft plugs," batches of mud loaded with fiber and flake material, when displaced into fissures.

LOST-CIRCULATION PLUGS. Neat cement has no place as a lost-circulation plug because its density is high, above 16 pounds per gallon (120 pounds per cubic foot). It is very fluid and lacks gelling or angle-of-repose properties. A long column of such a fluid in the drill pipe in a well which has lost returns with a lightweight mud, drops with high velocity and is likely to do nothing but make the loss zone more open.

Gel-cement plugs have been used for over 20 years in attempts to plug loss zones. Their main application is where the loss zone is at bottom, as with the Devonian losses in the Canadian plains. There are a number of reasons why gel cement is an unsatisfactory plugging agent. The density is relatively high, about 14 pounds per gallon (105 pounds per cubic foot) is the minimum; it contaminates, both in placement and while drilling out, all drilling fluids except the lime muds; in placement there is always the possibility of sticking the drill pipe and the plugs are, therefore, rarely squeezed; in drilling out there is always the possibility of losing the hole by sidetracking the plug. Another unsatisfactory plug is the sodium silicate-clay plug which is an expensive, difficult plug to place and has never been widely used.

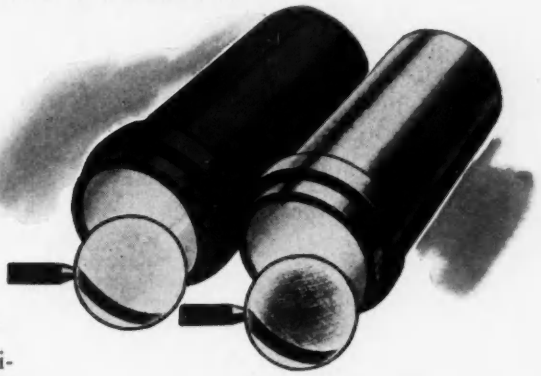
The effect of mud contamination from drilling cement should be further considered. When a gel-cement plug has been displaced to a loss zone and a good fillup secured, the upper part of the plug will be drilled out with full returns. Often, however, as the bit nears bottom returns are lost and it is usually assumed that the zone was not fully sealed. In many instances, however, the second loss should be attributed to the increased pressure resulting from pumping out a long column of thickened, cement-contaminated mud. Oil-bentonite or time-setting clay plugs do not have this disadvantage.

It should not be concluded, however, that a gel-cement squeeze is not sometimes an important lost-circulation corrective. Cannon[13] has described such an application in a 16,255-foot East Texas well having more than 11,000 feet of open hole, a high-pressure sand "kicking" from bottom, and lost returns. Some successes with "burlap plugs" have recently been reported in the Rocky Mountains. Squares of burlap or canvas, one or two feet on a side, are rolled up and lubricated into a gel-cement plug through a lubricator located between the well head and cementing truck. The cloth can be considered to be reinforcing material and to increase the angle-of-repose property.

In the past two years, three new types of plugs have been developed. These have low densities, will not stick drill pipe, and do not contaminate drilling fluids. Oil-base mud of certain types will thicken immensely when contaminated with water or drilling mud. Displacement of about five barrels into a loss zone, where it thickens on mixing with mud and formation water, is a useful lost-circulation corrective. Diesel-oil spacers ahead of and behind the oil-base mud could be used, but in most applications are omitted. The diesel or crude oil-bentonite (approximately 300 pounds of bentonite suspended in each barrel of oil) plug[6,9] is a similar plug. The mixture is very fluid when being displaced; but when formation water and drilling mud contaminate and mix with it, the material thickens to resemble modeling clay. Diesel-oil spacers are generally used with these plugs. The time-setting clay plug is also a recent development and is well described in reference 14. This plug has rather quickly come into wide use and many successful applications have been reported.

Just how strong such plugs are or, for that matter, what strength is required of a lost-circulation plug is not known. Some preference for gel cement because of higher strength will continue, but this should not be a

Why Super-Service liners were dressed up in a Satin Finish



With the continuous increase in mud pump pressures, it became evident to Mission engineers several years ago that an improved type liner could save the industry thousands of dollars a year. Too many piston failures could be traced directly to the liner as the main cause of failure.

So Mission set out to eliminate these causes of liner failure . . . and to produce a better liner IN A COMPETITIVE PRICE RANGE to match the long-life quality of Mission Pistons, Valves and Rods.

First, Mission selected forgings of special alloy steel for careful heat treatment to secure a deep, file-hard case. Precision machining and rigid inspections followed.

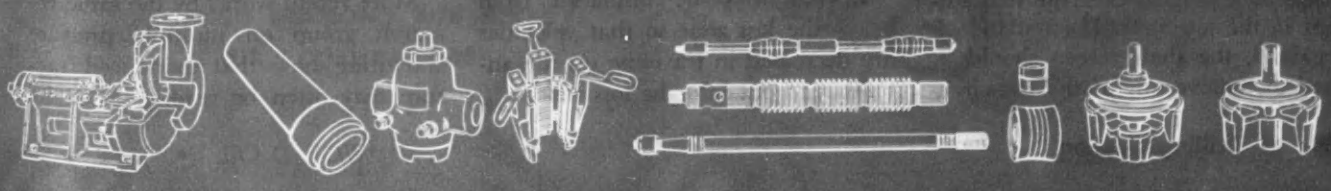
Then, Mission did what no other liner manufacturer has ever done . . . before or since. To liner bores that were accurately honed to extreme smoothness, Mission applied the exclusive Satin Finish process* WHICH PRODUCES A FINER, MORE ULTRA SMOOTH FINISH THAN CAN BE SECURED BY REGULAR HONING OR GRINDING.

That's why Mission Super Service Liners with Satin Finish* have proved beyond question to insure longer life for liners and pistons. Available through supply stores.

MISSION
MANUFACTURING CO.

P. O. BOX 4209 • HOUSTON, TEXAS

Export Office: 30 Rockefeller Plaza, New York



controlling factor in the selection of a plug.

SOFT PLUGS AND BRIDGING-PARTICLE PLUGS. The commercial lost-circulation materials are generally well known and may be classified in two groups, viz.:

1. Fibers and flakes
   a. Plant, wood and bark, and synthetic fibers
   b. Animal fibers such as wool linters or leather fibers
   c. Cellophane and cork flakes
   d. Mica
2. Bridging particles (some are sized)
   a. Expanded perlite[15] and coated coke fragments
   b. Fragmented, set plastic and walnut shells
   c. Gravel pebbles

Howard and Scott,[4] in a recent paper, present experimental work with a stimulated fissure apparatus connecting the concentration in mud of the two types of lost-circulation material with the width of fissures at which seals across the face of the fissure (not within the fissure) can be accomplished (Figure 1). Their work indicates that a concentration of about 14 pounds of flake or fibrous material per barrel of mud will bridge over fissures with widths up to 0.10 to 0.12 inches. Increased concentrations will not bridge on fissures of greater width and simply pass through. The critical concentration with a bridging-particle material was about 20 pounds per barrel, and the critical width of fissure was between 0.18 and 0.20 inch. When a serious loss is encountered, a good present practice would be to mix 50 to 150 barrels of mud near the pump suction, to a concentration of 14 pounds per barrel, of a mixture of three of the fibrous and flake materials or to a concentration of 20 pounds per barrel of expanded perlite, and then displace it to the loss zone as a plug. Such treatments can be repeated several times to insure that the batch of loaded mud has been displaced into the loss zone. If circulation is not established, recourse must then be made to a plug of the type that stiffens in the loss zone. If circulation is regained, the shale screen should be used to remove any of the lost-circulation material which has joined the circulating mud.

CHANGE OF METHOD—PLUGS TO BLIND DRILLING. A recent well in the Denton field, New Mexico, fought a loss zone occurring near 10,000 feet for 53 days with no success. A great number of plugs of many types, utilizing a total of 9000 sacks of cement and large quantities of other materials, were placed without effect. The fluid level stayed at 1000 to 1400 feet throughout. Blind drilling was then resorted to; and, after drilling a few hundred feet, 7-inch casing was cemented.

In a more recent well in Denton, a complete loss occurred at 9750 feet which was cured with five gel-cement and oil-bentonite plugs after the pumping away of 20 tons of bulk fiber and flake material had no effect. Drilling continued and another loss zone was encountered at 10,494 feet. Twenty-one varied plugs were placed and some drilling was done to 10,550 feet, but circulation was never regained. Blind drilling with water was then commenced, and within 12 hours partial returns were secured. Drilling continued to 11,300 feet with seepage losses of from 10 to 20 barrels per hour, which the circulating of fiber and flake materials did not decrease. A combination oil-bentonite and gel-cement plug was then squeezed into the loss zone, whereas previous plugs had gone away under vacuum. The plug was then drilled out and drilling continued to 12,100 feet with full returns.

It seems clear that the cuttings rising from the bit and carried into the loss zone bridged and closed the loss zone nearly completely. This occurrence raises the question whether a more practical procedure than long-continued blind drilling would be to drill blind through the zone (in the foregoing example to, say, 10,550 feet) and then displace through open-ended drill pipe in a thick gel-mud vehicle a quantity of a selected particle-size range of pea gravel, fragmented plastic, and walnut shells. Of course a great many such plugs have been used, but their record of success is not great and two suggestions are therefore made:

1. That they be displaced from below the loss zone so that velocities are decreased in traveling up the annulus and out into the loss zone.
2. That larger quantities of bridging particles contained in the larger amounts of mud be used than in older treatments.

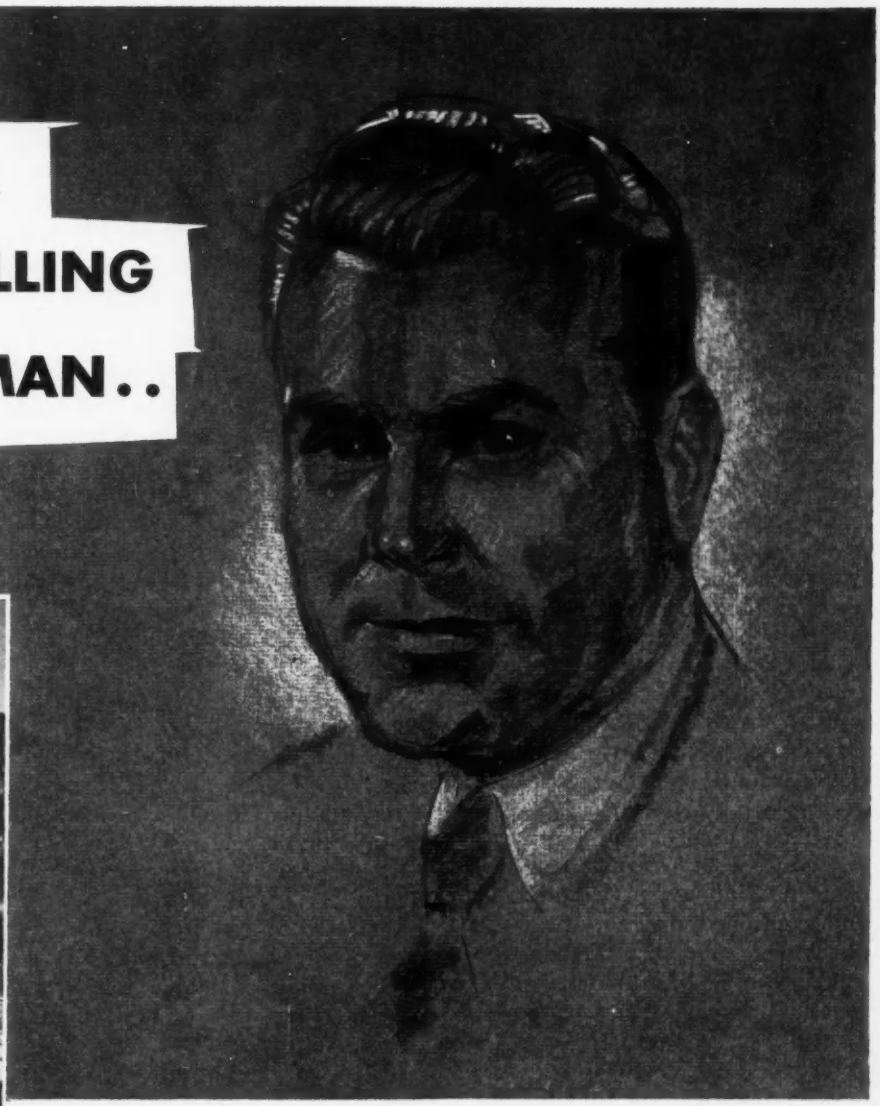
A conclusion as to change of method can be drawn from the foregoing well history:

1. Soft plugs, large quantities of bulk fiber material had no success; and, as this is true generally in this field, this plug should not be tried.
2. Hard plugs, five oil-bentonite and gel-cement plugs successfully sealed the zone at 9750 feet. Therefore, a reasonable number of such plugs should be used as a first effort.
3. If these plugs are not successful, blind drilling should be tried. It would seem that engineered, bridging-particle plugs should then be tried after only a short interval of blind drilling.

CIRCULATION OF LOST-CIRCULATION MATERIALS, OR PRETREATMENT. Howard and Scott[4] report tests in shallow simulated wells indicating that pretreatment, the addition to the circulating system in advance of loss of quantities of bridging materials, permits the imposition of considerably higher pressures on the formation before a breakdown or fracture occurs. This appears to be a dubious procedure with both low-solids and high-solids muds. Circulating lost-circulation materials requires that the mud bypass the shale screen. With the low-solids lightweight muds of the interior U. S., bypassing the screen permits quick buildup of solids to increase weight and cannot, therefore, be tolerated. Certainly, any increased mud weight will contribute to losses. With high-solids muds, the addition of lost-circulation material will increase pressure against the formation because of thickened mud cake, increased viscosity gels, and increased balling tendencies. Fine wood fiber or fine mica in concentrations of 1 to 5 pounds per barrel of mud are recommended for pretreatment because they will pass through shale screens. It is difficult, however, to believe that such fine materials at such low concentrations can have any beneficial effects.

More recent work[5] by the same research group on multiple pressure fracturing shows that an induced fracture may often be readily sealed by

BEHIND YOUR DIAMOND DRILLING STANDS THIS MAN..



C. Deely, President Drilling & Service, Inc.

. . . with a world-wide staff of capable D & S engineers, experienced in specifying the right equipment — ready to assist with on-the-spot service. Another reason why D & S diamond equipment gives you highest penetration at less cost per foot.

TRUCO DIAMOND BITS AND D & S CORE BARRELS

DRILLING & SERVICE
3031 Elm Street
Dallas 1, Texas

the displacement to it of a batch of mud thickened with bridging particles. Thus the use of bridging-particle plugs provides a way of "eating the cake and having it too." The circulation of heavy concentrations of lost-circulation material, with its attendant bad effects, can be omitted; and, if a fracture is induced, it can be remedied by the spotting of a batch of loaded mud.

PROPER USE OF LOST-CIRCULATION MATERIALS. From the preceding two sections the suggestion is plain that a completely new evaluation should be made by the drilling industry of the use of these materials for combating lost circulation. For example, the citing of successful applications of these materials in wells which were drilled without any control of the drilling practices which cause large surge pressures or were drilled with muds having a density to give, for example, 1250 psi overbalance on the loss zone, would seem to be purely defensive.

What is needed is to collect new experience with these materials in wells using the minimum proper mud weight and controlled drilling practices. It seems when the facts are developed that the use of these materials will be much restricted as compared with the present.

LOST CIRCULATION IN THE LEDUC FIELD, CANADIAN PLAINS. This great field is practically drilled up, but some observations there may have application in other fields. In wells located in the east flank area, the drilling fluid was generally pretreated with sawdust before entering the vugular Devonian formation. In general, this was successful and less than 24 hours rig time was consumed with mud losses. Wells drilled in the central portion of the field frequently lost about 48 hours rig time in displacing mud loaded with sawdust and other lost-circulation materials into the loss zone.

Wells situated along the west face of the reef frequently had real lost-circulation difficulties which required much more than 48 hours to clear up. In these wells the dropping of gel-cement plugs was resorted to; this procedure is detailed in reference 1, page 78. The common mud weight in the field was 10.5 pounds per gallon (78.5 pounds per cubic foot) and the Devonian was under a subnormal pressure gradient of about 0.37 psi per foot and the overbalance was of the order of 800 psi. Inasmuch as an 8.5 pound per gallon (63.5 pounds per cubic foot) mud would give about 325 psi overbalance, it would appear that decreased mud weights might have nullified or minimized the more difficult lost-circulation occurrences.

DRILLING WITH WATER. Much West Texas drilling is done with water because it is the cheapest and fastest drilling fluid. It is understandable that losses to the formation can be continuous and, for example, a loss of 15 barrels per hour is not considered serious. When losses increase, a leather fiber[16] circulated in the drilling fluid has an outstanding record of success. An older treatment is to suspend scrap cellophane in the fluid. Also, the oil-base, oil-bentonite, and time-setting clay plugs have been used with success in seepage-loss zones.

CASING CEMENTATION. A most annoying type of loss is that where it is discovered, after much rig time has been consumed, that the lost mud is traveling back of surface or protective casing because of a channeled cementation. In any lost-circulation territory the use of the scratcher-centralizer-reciprocation technique for cementing both surface and protective casings seems justified.

A special type of lost circulation is the failure to secure proper fill-up in cementing casing because the cement goes out into the formation rather than rising in the annulus. The universal solution is to use lighter weight cement slurries. A good, neat cement slurry will weigh at least 16 pounds per gallon (120 pounds per cubic foot); one with a high bentonite concentration about 13 pounds per gallon (97.5 pounds per cubic foot); and current work is being carried on with expanded perlite and pozzolans as additives to gel cement to yield a density measured at atmospheric pressure as low as 10.5 pounds per gallon (78.5 pounds per cubic foot). Pressure increases the density of perlite-gel cements and they are generally used, therefore, only for surface-string cementation.

SIMULTANEOUS LOST CIRCULATION AND BLOWOUT. Occasionally a well drills into a high-pressure zone with an insufficient mud weight and returns are lost while weighting-up the mud. Generally, the only satisfactory procedure is to plug off the high-pressure sand and then a string of casing can be set to exclude the loss zones. The placing of a barites or cement plug may be required to shut off the high-pressure zone and the procedures and considerations for this are set out in reference 1, page 61. Barites plugs have been chiefly used in the Gulf Coast, but they should be kept in mind as a useful tool in any area.

LOSSES IN THE GULF COAST. It is commonly accepted that the deeper a surface or protective casing string is set, the higher will be the mud weight that can be circulated without loss. Generally, no heavier than a 14.5 pounds per gallon (108 pounds per cubic foot) mud can be circulated in a deep well which has only 1500 to 3000 feet of surface pipe. Losses at lower weights than this are encountered often enough. No very successful way has been found to strengthen these long sections of open hole so that higher mud weights can be carried. Fortunately, normal-pressure zones can be safely drilled with mud weights from 9.7 to 10.2 pounds per gallon (73 to 76 pounds per cubic foot). If circulation is lost with a higher-weight mud, one procedure is to lower the mud weight to that which will circulate and to drill ahead to just above the first abnormal pressure sand and cement protective casing. The setting of protective casing at 9000 feet or deeper generally permits the circulation of 16 to 18 pounds per gallon (120 to 135 pounds per cubic foot) muds.

If a generalization must be made as to the location of loss zones in Gulf Coast wells, it can be said that they are never, or rarely, at bottom and in general are close to the last casing shoe.

When circulation is lost while drilling below a protective string with high-weight muds, the fluid level generally remains at the surface and the pressure in the annulus required for circulation, therefore, causes the loss. This pressure depends upon the clearances, the viscosity of the mud, and the rate of circulation. Where high-weight muds are to be used, as large clearances as possible should be provided, the mud should be a lime-emulsion mud for low viscosity and gel strength, and should have the minimum safe weight.

If losses occur, circulation should be at reduced rates even though the drilling rate is slowed. The rig should

be handled to avoid all pressure surges. Waiting periods should be used as a first treatment. Then displacement of one of the lost-circulation plugs should be undertaken. Lost-circulation materials should not be circulated in the mud.

LOSSES IN CLAM LAKE FIELD, UPPER TEXAS GULF COAST. This field is located on a medium-depth salt dome and the normal fault pattern common to such structures is prominent. A recent well with surface casing at about 1000 feet, drilled with a lightly treated 9.8 pounds per gallon (73.5 pounds per cubic foot) mud to about 4100 feet, which was at or near the intersection of two prominent faults, when circulation was lost and the fluid level dropped some hundreds of feet. Apparently, the drop in fluid caused some uncemented sand near the casing shoe to fall in and freeze the drill pipe. Another well indicated that this occurrence could recur and additional wells in the faulted area have, therefore, been drilled below the surface string with light concentration, 4 to 6 pounds per barrel, of fiber and flake material in the 9.8 pounds per gallon mud. Such treatments can be considered as insurance, and being of low concentrations, are inexpensive and do not interfere with drilling.

Conclusion. When a well is being planned, the possibilities of lost circulation should be considered and the circumstances of the loss or losses and procedures used in similar wells in the vicinity should be studied. A program to properly handle the lost-circulation occurrences can then be prepared. Important considerations in preparing such a program are the use of the minimum safe mud weight; the handling of the rig to avoid all pressure surges; any possible benefits should be taken from waiting periods; lost-circulation material should not be circulated except with well-understood conditions; lost-circulation plugs should be selected of the type most likely to succeed under the indicated conditions; and, finally, special drilling methods should be instituted after other procedures have been given a reasonable number of applications.

Acknowledgment and complete reference list was printed with Part I of this article in the May issue of WORLD OIL (pp. 150-158).

(Second of Two Parts)

It's Easy to Get Hurt!

Editor's Note: *It is axiomatic in the industry that accidents seldom happen on unusually hazardous jobs. It is the easy, routine task that invites carelessness and causes injuries. This is the first of a series of pictorial safety messages taken directly from the files of companies in the drilling industry. Clip them. Put them on your bulletin board. Drive home the warning that IT'S EASY TO GET HURT!*

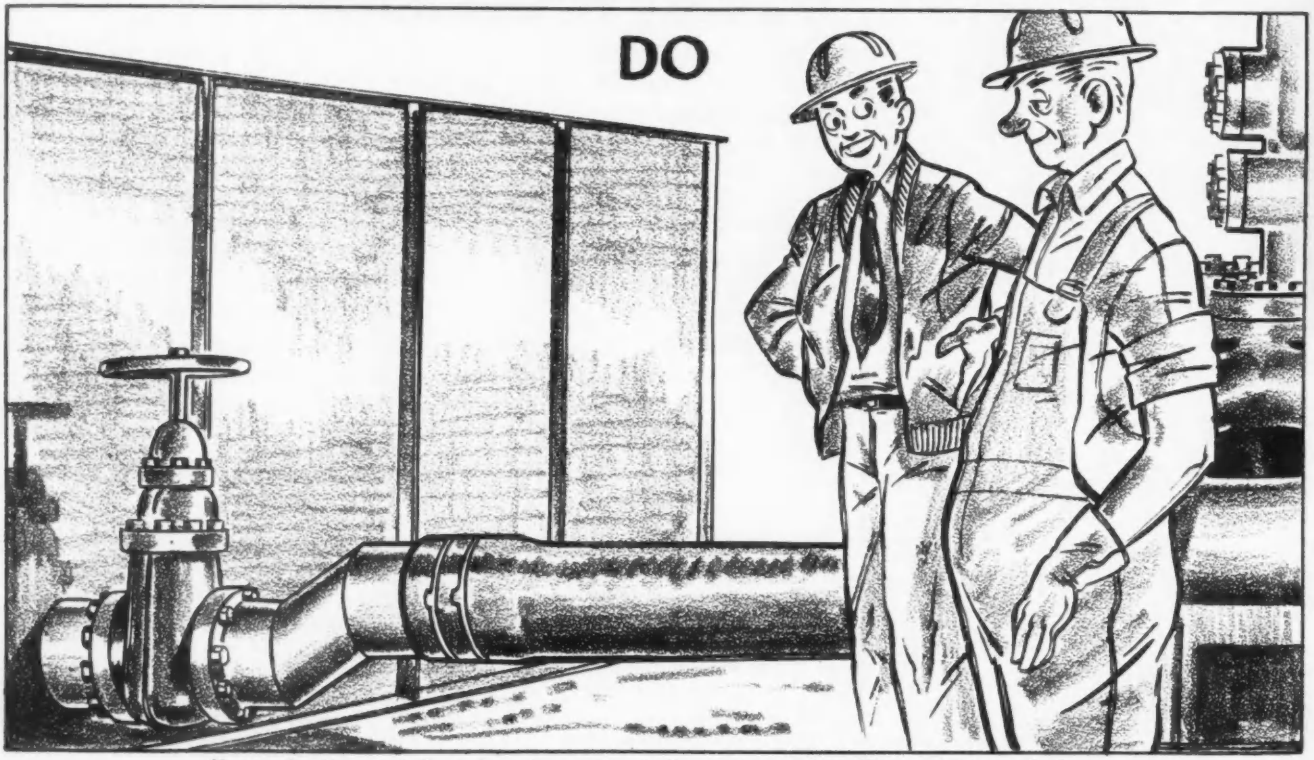
The Accident: Crew was going in hole with 3½-inch drill pipe and was on the last row before reaching bottom. Employe was tailing pipe in from the rack to the pipe racker when his hand got fouled between the joint swinging in and the tongs, which were on box in rotary table. Result was a severely lacerated and fractured finger.

Safety Director's Report: The injured man was a new employe who failed to carry out the instructions of the driller and crew members. He had been told to turn the pipe loose when it looked as though he would not be able to stop the pipe before it struck the tongs.

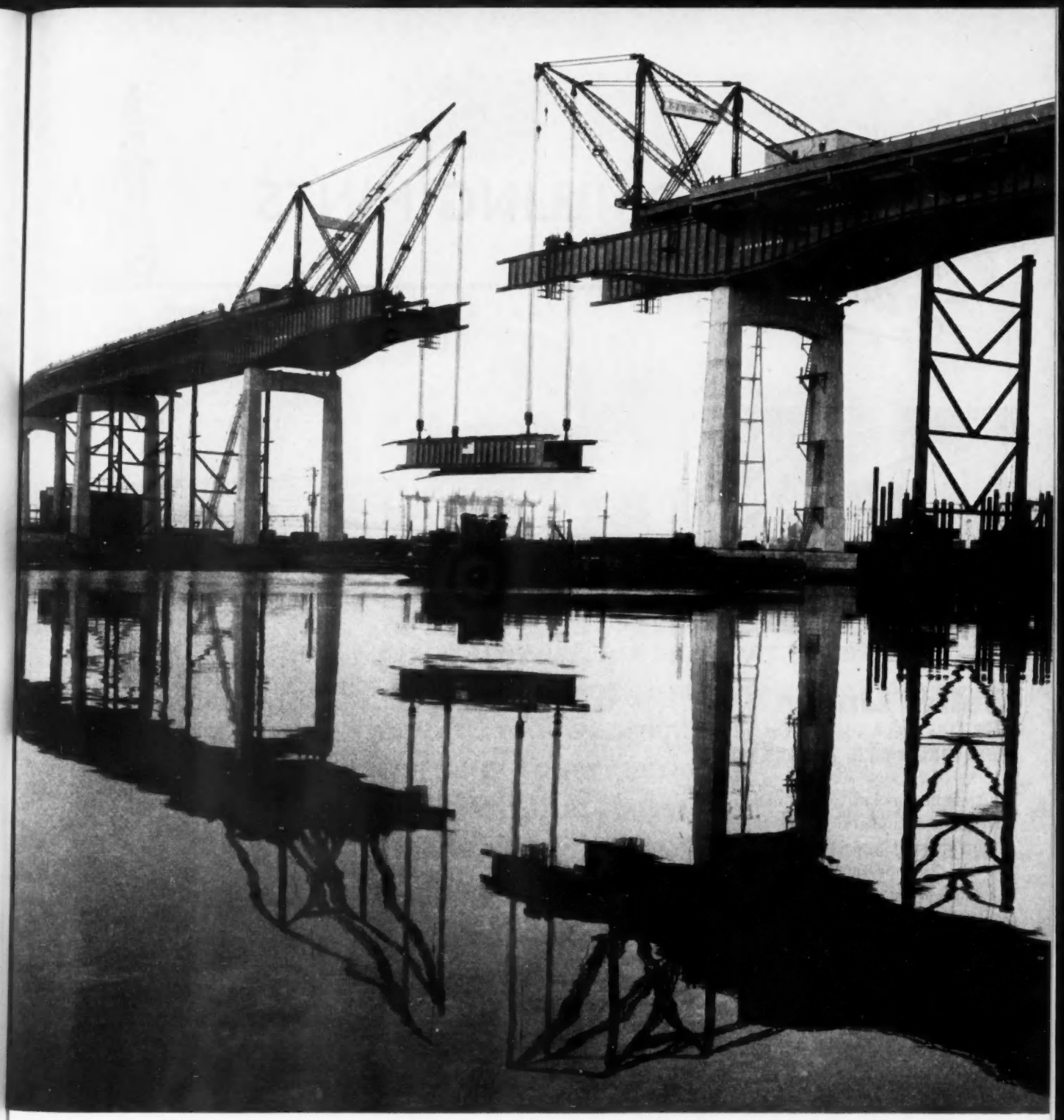
World Oil Graphics

Suction Hose Care

Serious misalignment of suction hose fittings, coupled with pump pulsations, materially shortens suction hose life.



Shop-made offset nipple flanged to valve permits misalignment correction; allows straighter run for hose.



Wire Rope at Work—As you draw near New York City at the northern end of the 118-mile New Jersey Turnpike, this is the bridge that carries you high above the Passaic River. The picture, taken at a time when the bridge was near completion, shows two 146-ton girders for the main span being lifted simultaneously into place by Bethlehem Wire Rope.

These heavy steel girders made a tough lift, but no tougher than thousands of others entrusted to Bethlehem rope all over the country. Wherever there are heavy lifting or hauling jobs to be done, you will find Bethlehem rope right in the thick of things, hard at work. You will always know it by the black-and-yellow reel, the reel that tells you, "Here a good product is in service."

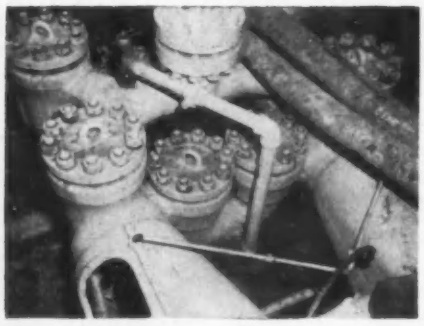
Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:
MINING • CONSTRUCTION • PETROLEUM • EXCAVATING • QUARRYING • LOGGING • MANUFACTURING

DRILLING HINTS

How to do it!

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

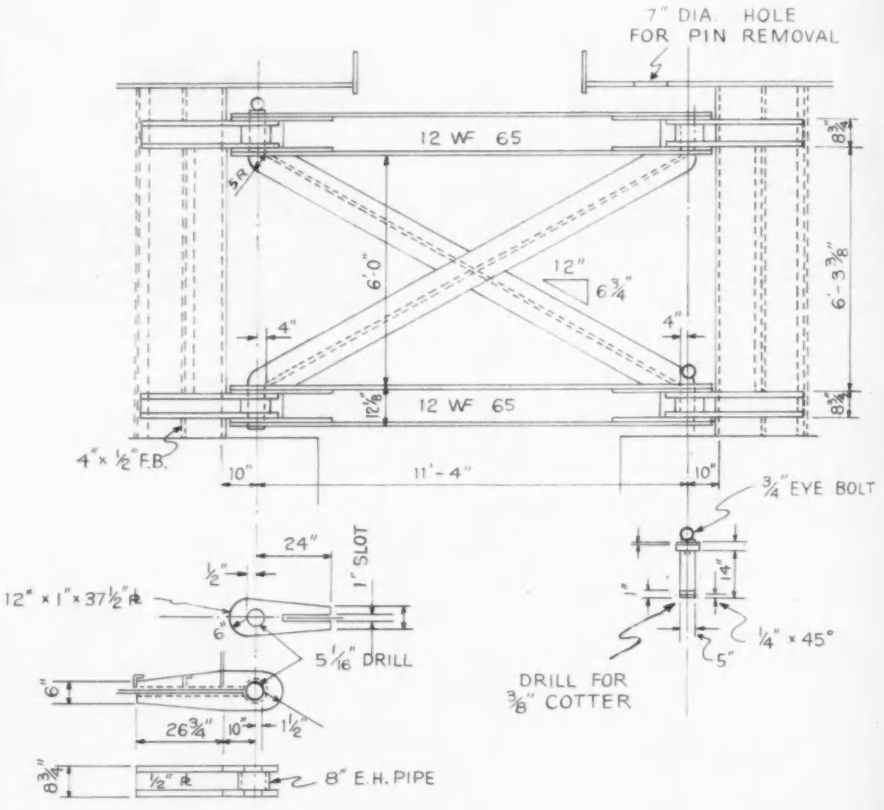


Relief Line Connects Suction

A simple hookup which makes the relief line an integral part of the mud pump makes the problem of hooking up and disconnecting on each location a simple one. Mount a shear relief valve on the discharge manifold of a pump and turn it toward the back of the pump. Connect the line to a two-inch connection in the suction manifold near the bottom of the pump, using a wing union.

Set the shear relief valve for any desired pressure and it will effectively protect the pump and discharge lines and hose. If the limited pressure is reached on any future location such as could occur by pumping against a closed valve or a plugged bit, the nail will shear and the pump pressure will immediately fall to zero, limiting pump damage. Replacing the shorn nail will pump, and correcting trouble will put pump back in operation.

All of the connections are well protected during moves and are below the top of the pump where they will not be damaged by any obstructions during moves.



Hinged Slot Gate Averts Deflection

Drilling slots on modern barges should be protected from structural stresses imposed during actual drilling operations. Hinged structural gates which are located across keyway at the aft end of the pipe rack are pinned to the main structural members above deck. This restricts the deflection tendency of the slotted portion of the barge hull.

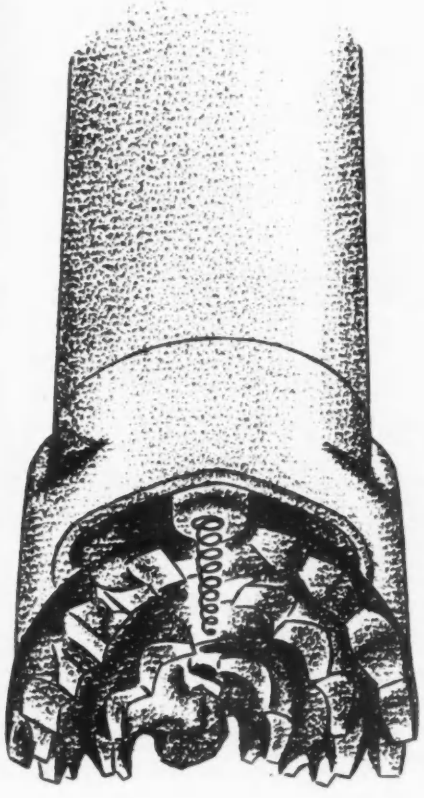
The huge gate is hinged at the four corners by pins 5 inches in diameter and 14 inches long. When moving in or out of locations, the pins are removed and the gate is swung open to either the left or the right. After the sills have cleared the slot, the gate is swung closed.

Weighting Material Dries Drill Pipe

Small amounts of weighting material are used for a purpose somewhat removed from that of formation control. "Pills" or slugs of weighted mud of a higher weight than that of the rest of the mud system are placed in the drill pipe. By increasing the weight of the mud in the drill pipe so that it is higher than that of the mud in the

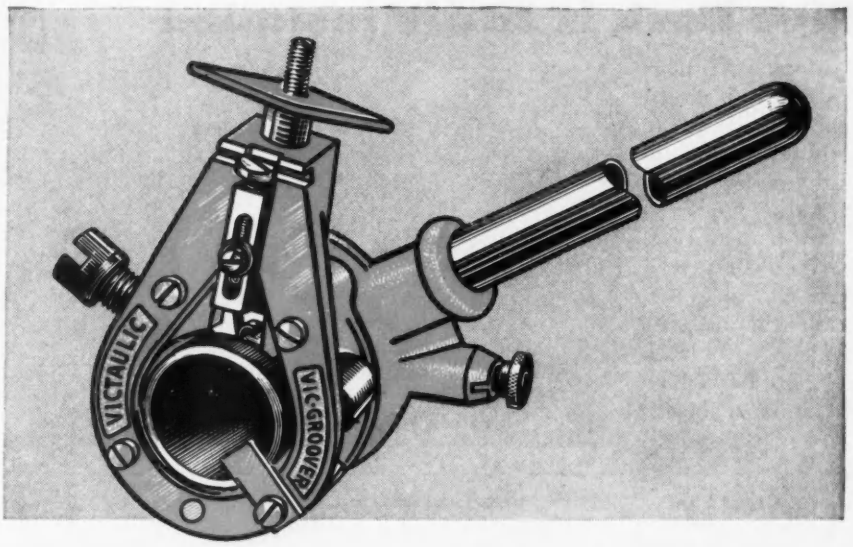
annular space, the level of the mud in the former can be lowered to a point where it will not flow out of the pipe when connections and round trips are made. The amount of weighting material required for this purpose will vary with the condition but is usually from 5 to 20 sacks.

If facilities, such as a "pill tank," are available for mixing the weighted mud with a small batch of mud, it is possible to pump the heavy mud directly into the drill pipe. Otherwise, the weighted mud is added rapidly through the conventional mixer and discharged close to the well pump section.



Coil Spring Prevents Mud Plugging Action

Insert a lightweight coil spring in the nozzles of jet bits to prevent plugging when going in the hole. The vibrations set up by the spring resists the plugging action of mud being forced into the water courses as the drill pipe is lowered in the hole. Some operators recommend inserting wooden pegs, making certain that the pump pressure will force them out.



THE EASIEST WAY TO MAKE ENDS MEET

VICTAULIC'S HANDY, PORTABLE VIC-GROOVER TOOLS FOR GROOVING STANDARD PIPE ENDS WITH SPEED AND EASE, ARE ONLY PART OF THE COMPLETE MODERN VICTAULIC 4-STAR METHOD OF PIPING. YOU ARE ASSURED FAST, STREAMLINED EFFICIENT CONSTRUCTION THAT SAVES $$$$ WITH: VICTAULIC COUPLINGS FOR LOCK-TIGHT LEAK-PROOF CONNECTIONS AT EVERY JOINT UNDER PRESSURE OR VACUUM, *PLUS* VICTAULIC FULL-FLOW TEES ELBOWS AND ALL TYPES OF FITTINGS ALL WIDELY ADAPTABLE AND EASY-TO-INSTALL, AND QUICK HANDY ROUST-A-BOUT COUPLINGS FOR PLAIN END PIPE AND ALL-AROUND VERSATILITY! MAKE *SURE* YOUR NEXT JOB IS ALL VICTAULIC! PROMPT AVAILABILITY FROM LOCAL DISTRIBUTOR STOCKS COAST-TO-COAST.

Write today for Victaulic Catalog-Manuals Nos. 44-81

VICTAULIC COMPANY OF AMERICA · P. O. Box 509 · ELIZABETH, N. J.

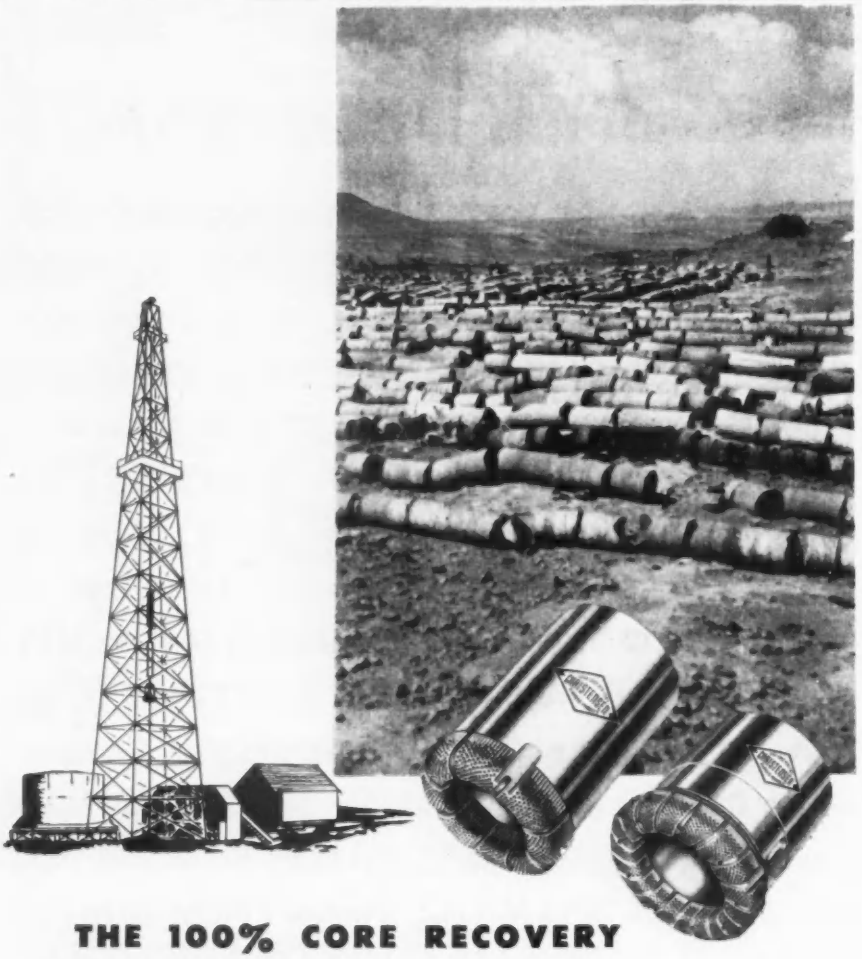
Office and Plant: 1100 Morris Ave., Union, N. J. • Telephone Elizabeth 4-2141

West Coast: Victaulic Inc., 2330 East 8th St., Los Angeles 21 • *Canada:* Victaulic Co. of Canada Ltd., 406 Hopewell Ave., Toronto 10 • *Export:* Pipe Couplings, Inc., 30 Rockefeller Plaza, N. Y. 20, N. Y.

COPYRIGHT 1953 BY VICTAULIC CO. OF AMERICA

Pipe Rack Is Easily Installed

Make a simple, and easily installed pipe rack which can be used as a foundation for other operating equipment if necessary. Each section is a skid type member, using structural steel "I" beams for each side, both of which are connected with cross pieces and diagonal braces. Lay the sections directly upon the ground extending away from the walk, using as many as necessary to complete the desired width of the assembly. Top with channel iron sections to retain cushion timbers and provide the sections with saddles beside the cushions to retain short pipe nipples as connections so that pipe may be rolled easily from one side of the rack to the pipe walk. Transportation will present no difficulty, as each section is stacked upon another to form a compact load on an oil field truck.

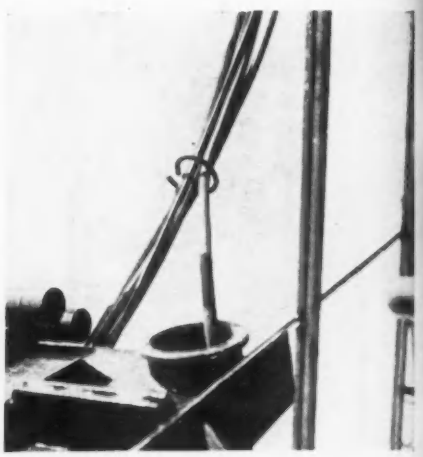


THE 100% CORE RECOVERY YOU PAID TO SEE

3,451 feet of core — the entire story of your well with no chapters missing. Diamonds mean faster, deeper penetration and greater core recovery. Your results — Less Cost Per Foot!

CHRISTENSEN
DIAMOND PRODUCTS COMPANY

1937 South 2nd West - Salt Lake City, Utah



Steel Loop Useful In Grouping Cables

When the several major units of a drilling rig are connected together with the assorted half-dozen or so electric cables, any handy piece of scrap rope or wire can be used to lash them together into a more convenient bundle. One method is to use a loop of sucker rod material of about six or eight inches in diameter to group the cables together. The loop is partially open, with the two ends overlapping slightly. A gap is provided that allows passage of one or two cables at a time.

Not only is the use of such a loop easier and quicker to manipulate, but it provides a degree of flexibility in allowing workmen to slide it along in either direction to obtain the desired compactness of the cable. In addition, there is no danger of having a cable accidentally cut when, on tearing down of the rig, workmen use a pocket knife to remove the pieces of rope commonly used.

PROOF AGAIN—
at the Big Tulsa Show
DIAMOND ROLLER CHAINS

Shot-Peening Since 1944

To increase the fatigue resistance of Diamond Chains, link plates have been specially processed, and chain rollers and other parts have been shot-peened since 1944.

Patented BCL Connector

The patented, bushed-centered-plate BCL connector for multiple-strand press-fit center-plate chain has simplified connecting and disconnecting, and assures full value in Diamond Chains at the connecting links.

Press-Fit Center-Plate Construction of Multiple-Strand Roller Chain

Diamond's press-fit center-plate construction of multiple-strand chains provides equal distribution of loading across the chain width—throughout the entire, longer service life.

Rigidity of Link Construction

Special finishing of link plate pitch holes, providing 100% contact of pins and bushings in their respective link plates, considerably enhances the uniform and substantial press-fitting of these parts, assuring maximum rigidity of link construction.

ON THE COUNTRY'S FOREMOST OIL FIELD EQUIPMENT

DRILLING • PUMPING • SERVICING RIGS

• The greatest number ever to attend an International Petroleum Exposition again saw proof of the wide preference for Diamond Roller Chains. On dozens and dozens of America's finest modern rigs made by the recognized top-flight manufacturers of oil country machinery, the Roller Chains used were identified by the well-known "Diamond" mark . . . For over 30 years of application in oil fields all over the globe, these Chains have proven their stamina, uniform high quality, and long-life dependability.

DIAMOND CHAIN COMPANY, INC.

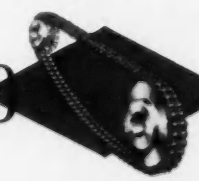
Where High Quality is Traditional

Dept. 485, 402 Kentucky Ave., Indianapolis 7, Indiana

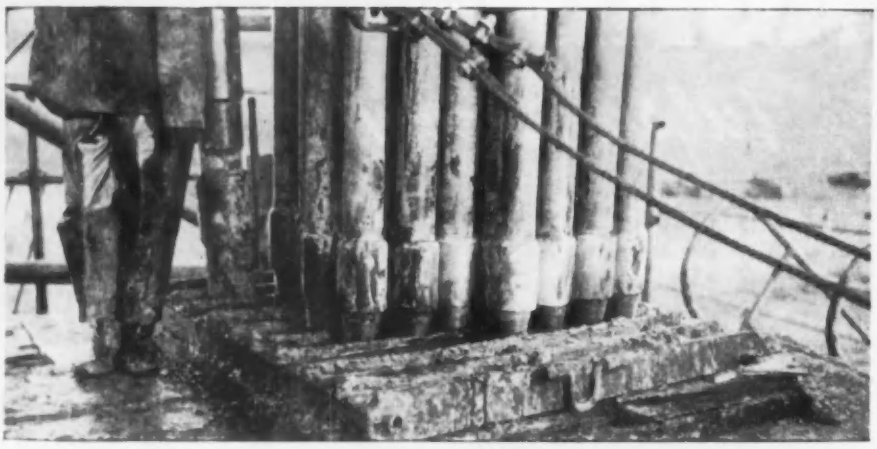
Tulsa Office: **2238 Terwilleger Blvd.**

Offices and Distributors in All Principal Cities

Please refer to the classified section of your local telephone directory under the heading CHAINS or CHAINS-ROLLER



DIAMOND ROLLER CHAINS



Heated Stand Reduces Ice Plug Formation

One of the more satisfactory solutions to the problem of frozen mud collecting in pulled drill pipe is the construction of a specially-designed base, through which steam can be circulated during periods of freezing weather. This base is reinforced to support the weight of the stands of drill pipe. Lengths of channel iron, laid side by side and with the channel side looking up, provide orderly rows in which the stands can be racked. Visible on one side of the heated base are the two fittings to which incoming and return lines are attached. A retractable handle, welded to the side, permits the unit to be lifted and moved with ease.

Worn Jars Used For Lifting Nipple

One Pennsylvania contractor uses the lower part of a set of jars to make an effective bail to attach the sand line or wire rope to the various tools at hand. Cut jars a few inches above the top of the box connection and fit a rounded piece of bar stock in the space between the prongs of the jars. Weld the bar stock to prongs to provide a bail for fastening th_ drilling or cleanout line.

The bar is welded in place and cooled and the wire rope is attached, using a regular bailer hitch. The box is then screwed into the top of any piece of equipment of the size to be run into the hole. Several of these connections can be made with one for each size of drilling or fishing tool to be run.

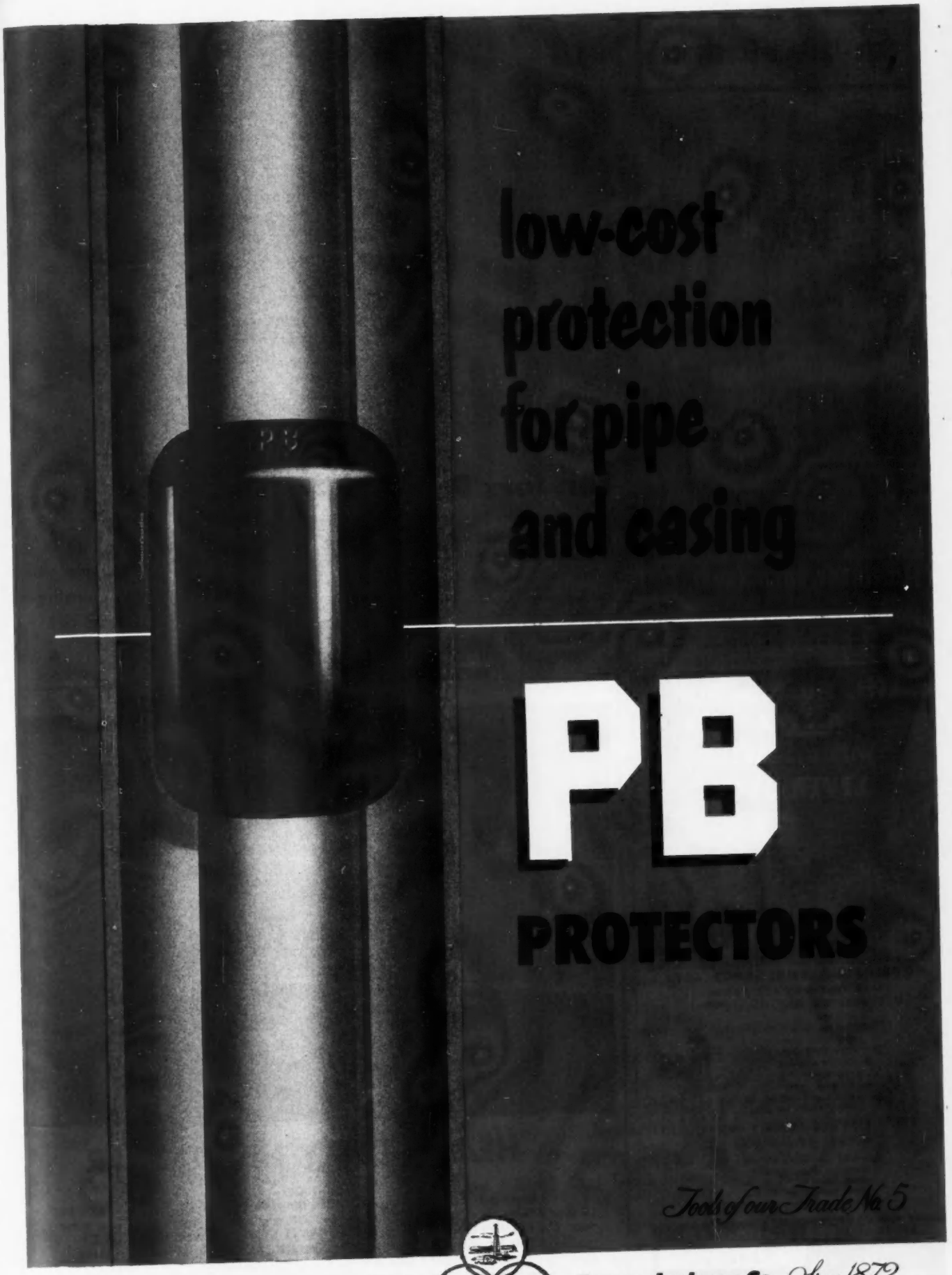
"FLOLIGHT" RIG LIGHTS

VAPOR PROOF DERRICK LIGHTING EQUIPMENT FABRICATED TO FIT ALL SIZES AND TYPES OF DERRICKS AND MASTS

"IT'S QUICK TO RIG UP"

HUTCHISON MANUFACTURING COMPANY

6609 AVENUE U • HOUSTON 11, TEXAS



PB OIL FIELD RUBBER SPECIALTIES

BJ PB

Byron Jackson Co. Since 1872

LOS ANGELES NEW YORK FORT WORTH HOUSTON

Safe-Certain-Economical

SAND-BANUM

REMOVES AND PREVENTS BOILER SCALE AND CORROSION

Clean Boilers – New Efficiency, Economy and Power. Guaranteed harmless to personnel and equipment.

SAND-BANUM SPECIAL

TABLETS REMOVE AND PREVENT RUST AND SCALE IN ALL RADIATOR COOLING SYSTEMS

Just 1 Tablet to each 6 gals. of water for a cool cleaning system.

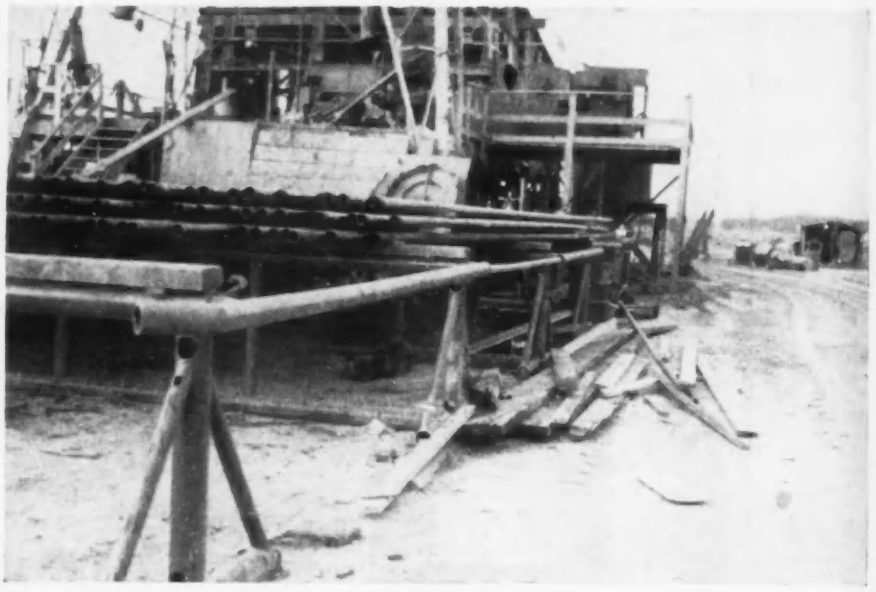
Stocked by Leading Supply Houses

AMERICAN SAND-BANUM CO.

Established 1926

9 Rockefeller Plaza

New York 20, N.Y.



Fenders Protect Pipe Rack Sections

To prevent dislocation of the pipe rack sections, a fender has been added to the access road ends so that a truck can be driven closely when unloading pipe. The fenders are made of three-inch pipe with curved ends and are attached to the ends of the rack sections with pipe nipples which are welded to the fenders for slipping into the open ends of the rack top sills.

Lift, Push or Pull AT ANY ANGLE with a SIMPLEX LEVER JACK

MODEL 310-A EMERGENCY JACK with four-way lift power

1. On the rotating cap.
2. On the auxiliary cap shoe (two positions).
3. On the machine corrugated toe.
4. At any intermediate point, using chain as sling.

LIFTS 15 TONS A FULL 14 INCHES

Model A-1022 Ratchet Lowering Jack has aluminum housing which reduces weight to 42 lbs. Capacity 10 tons.

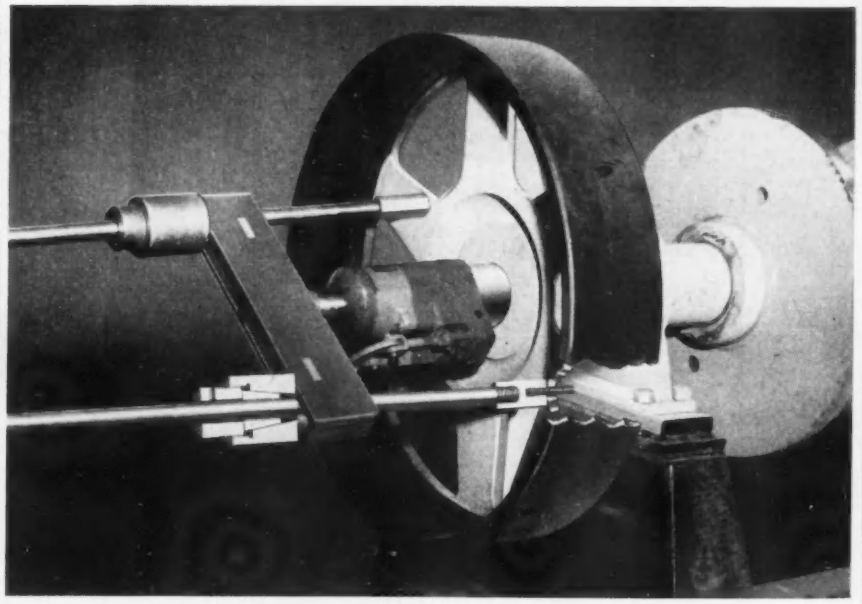
WRITE FOR COMPLETE INFORMATION

Simplex LEVER · SCREW · HYDRAULIC Jacks

TEMPLETON, KENLY & CO.

1032 S. Central Avenue, Chicago, Illinois

A. C. TEMPLETON, 5627 Del Roy Drive, Dallas, Texas



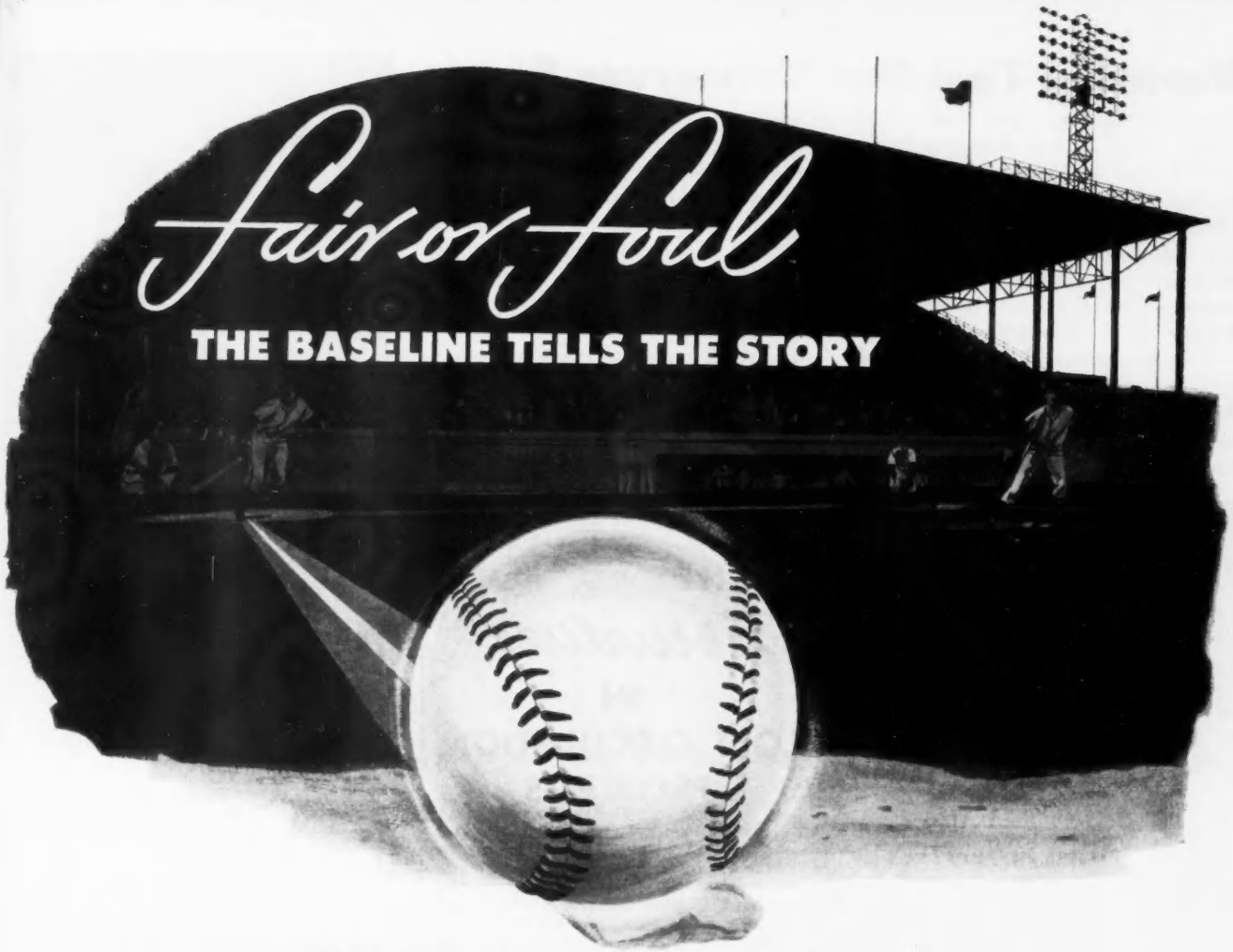
A HEAVY-DUTY HUB PULLER By Baird . . .

This heavy-duty hub puller set is designed for pulling hubs and any type of sprocket on your drilling rig drawworks. It can be used with any type of jack, hydraulic or otherwise. The adapters are made for holes from ½" to 1", and are made of 4140 H.T. Save time by using Baird's heavy-duty hub puller set for rig drawworks repairs.

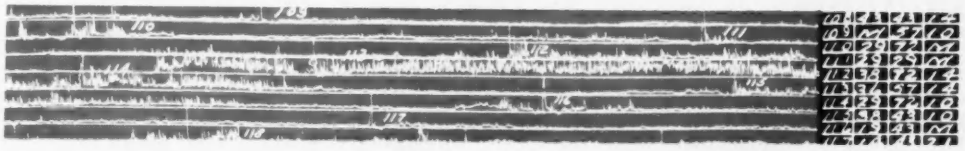
*Available through your supply store

BAIRD MANUFACTURING COMPANY

Box 380 • Tulsa, Oklahoma



...only TUBOSCOPE calipers have the baseline



measures erosion
measures corrosion
measures rod wear

Only the Tuboscope Caliper with base line measures corrosion, erosion, and rod wear easily and accurately. The exclusive Tuboscope base line represents the nominal ID of the tubing. Wall reduction is interpreted readily from the chart by direct comparison of the activated line with the base line. By comparing the ID as shown by the base lines on charts for several surveys of one string of tubing, it is possible to determine whether the ID is increasing — an indication of erosion which no caliper feelers can measure. The easily understood interpretation tells you the exact condition of your tubing. Tuboscope surveys wells under pressure and up to 9,600 feet in one run at speeds up to 100 feet per minute. You can be certain that you know the tubing's condition after a Tuboscope survey. You don't need to pull good tubing. Call Tuboscope now to survey your producing wells.

Tuboscope COMPANY

2400 HOLMES ROAD • HOUSTON, TEXAS

The Tuboscope Caliper is operated under license from M. M. Kinley Co.
Trade Mark Registered U. S. Patent Office.

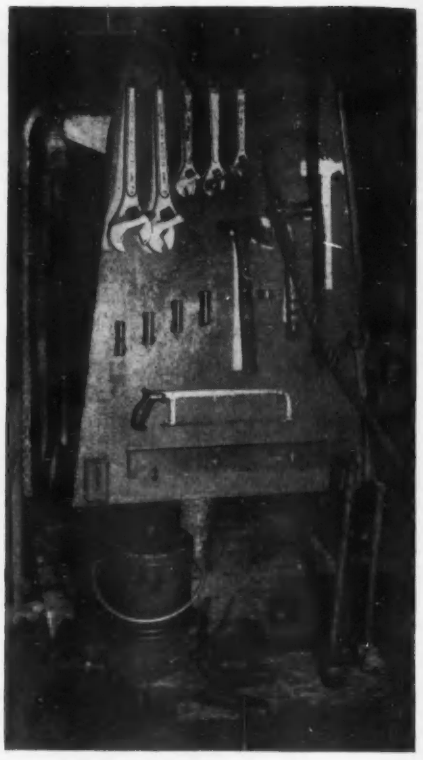
Rotating Tool Box Conserves Space

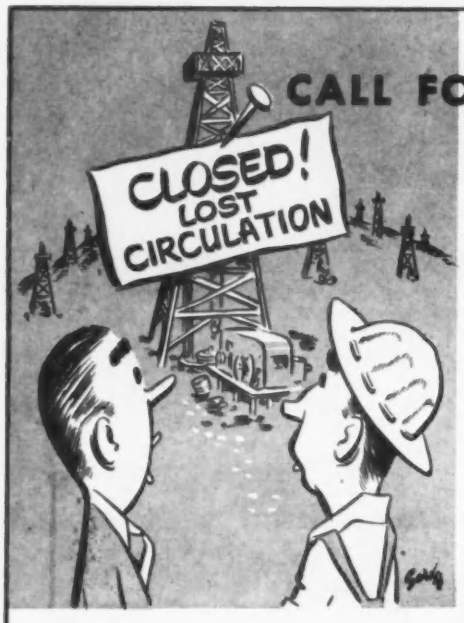
A rotating-type tool box which makes for good housekeeping on the derrick floor and considerable savings in time and tool replacements has been developed. Compact and convenient, it requires few materials for construction and occupies only a minimum amount of space for easy handling and hauling between locations.

This portable and maneuverable tool box is about 5 feet high with a 48-inch square base. The four sloping sides have been designed to handle all tools common to any drilling rig. Hooks are provided for crescent and other type wrenches so that they may be suspended by the handles. Their proper positions have been indicated by paintings on the exterior so that the tool pusher can tell at a glance when a tool is missing. One of the sides has a door opening into four interior shelves, which are used to store small pieces of easily lost equipment.

The box is built of ¼-inch steel sheets and scrap pipe. It is supported by a pipe trunk which is welded to a christmas tree-like base. The shelves are welded around the trunk pipe. The square base plate is constructed of ½-inch steel which has been cut the same size as the bottom of the tool box to provide a stable base to support the revolving unit above. By adding rollers to the base plate, the box can be rolled to any piece of drilling equipment where it is needed.

The revolving mechanism is made by placing 3-inch pipe inside of the 4-inch trunk, allowing it to rest on a ball bearing race at the top.





CALL FOR THE *Specialists* IN LOST CIRCULATION PROBLEMS

The William E. Sievers Corporation and Sievers Company specialize entirely in this difficult field and their international study of "lose outs" throughout the world, coupled with the hydraulic and displacement training of their personnel, facilitates a new service heretofore unavailable to the oil industry. The various applications of displacement, complementary chemicals, mixtures and processes have resulted in pleasing results in conquering mud losses ranging from small, depleted sand losses to those in the extreme instance of "lose outs" in cavernous sections. Their consultation and services are available at your inquiry.

THESE TWO MONARCHS CONQUER WHERE OTHERS FAIL

KINGSEAL

100% textile fibers, including varying lengths of wool, cotton, rayon, nylon and silk. For the required granular fillers the formula contains selected particle sizes of (soft) white pine sawdust. Kingseal is not subject to deterioration by hydraulic pulverization, fermentation or souring. In operation this strong textile material is the only one available that can and will work its way *into* the formation, build itself up into a "tailored plug" and do a permanent and adequate *caulking* job. It is specifically designed for use in formations varying from small sand pore losses to interstices of small to medium cracks, crevices and fissures.

QUEENSEAL

A bulk additive, specifically designed to combine packing ability, strength, durability and above all to resist breaking down under hydraulic pulverization and deterioration by bacterial and chemical action. It is a shredded, delignified *wood* combined with Kingseal's strong textile fibers and selected particle size sawdust. This bulk product may be placed into the formation in an *ample* form to accomplish its purpose. Queenseal is specifically designed for the larger fissures and cavernous sections.

THE WILLIAM E. SIEVERS CORPORATION
2499 Cerritos Ave., Long Beach 6, Calif
Phone 4-4247 or nite 9-7636

Casper, Wyoming, Box 1468
Phone Casper 2-3533

SIEVERS COMPANY
2499 Cerritos Ave., Long Beach 6, Calif.
Phone 4-4247 or nite 9-7636

Houston, Texas
Box 18061, Phone Yukon 1889

Odessa, Texas
211 No. Amburgey St., Phone 636-82

Foreign Distribution: J. F. HEROLD AND CO.
4700 Willow St., Bellaire, Texas, Phone–Houston–Mohawk 1600

Kingseal and Queenseal are available *at your specification* from most mud service companies

Want to make some easy money?

• Are you proud of an idea which makes your job easier . . . saves money . . . or time? Well here's a chance to let others in on it . . . and at the same time pick up some cash for your efforts. Just snap a picture of the timesaver. Send us the picture along with a penciled description. We'll do the rest. Just address your idea to the Drilling Hints Editor, WORLD OIL, Post Office Box 2608, Houston 1, Texas.

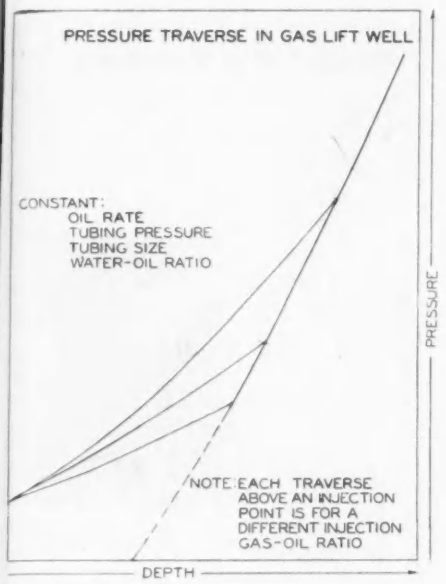


FIGURE 1.

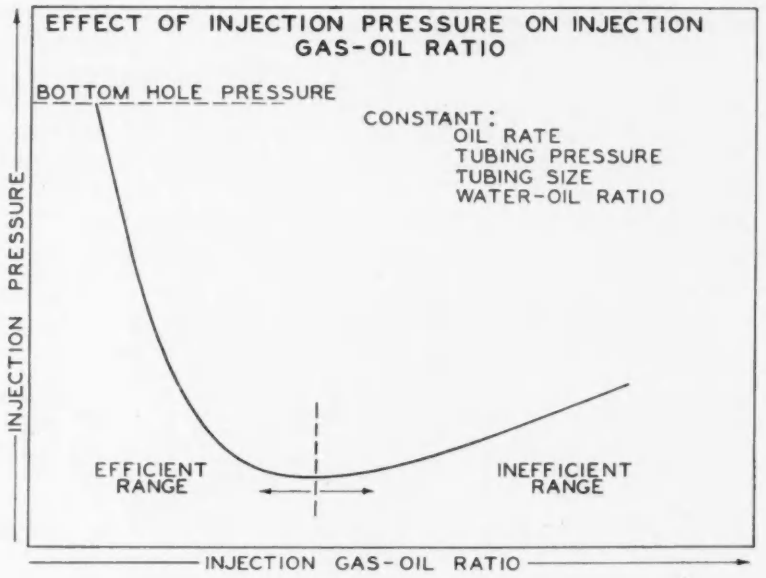


FIGURE 2.

New Correlation Simplifies Pressure Gradient Calculation in Tubing

- **More efficient gas lift installations can be designed.**
- **Flowing bottom-hole pressures can be determined from surface data.**

By FRED H. POETTMANN and PAUL G. CARPENTER
Phillips Petroleum Company, Bartlesville, Okla.

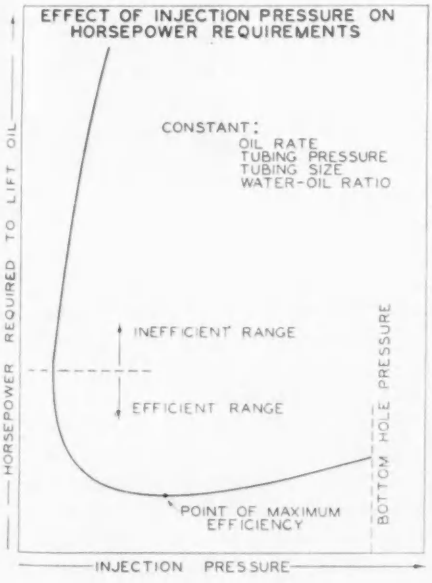


FIGURE 3.

A NEW CORRELATION simplifies and increases the accuracy in predicting and analyzing the flow of oil, gas and water through vertical tubing. Ability to predict variation of pressure with elevation along the length of tubing for known conditions of flow provides a means of evaluating the effects of tubing size, flow rate, and a host of other variables on flowing and gas lift wells. It is particularly useful in designing gas lift installations, providing information for locating injection depth, rate of injection, ideal horsepower needed to lift the oil, and the effect of production rate and tubing size on these quantities.

The correlation is based on field data from the Bureau of Mines, Bartlesville, Okla., and on data from the files of Phillips Petroleum Company. Although field data do not have the accuracy and precision inherent in laboratory data, a correlation based

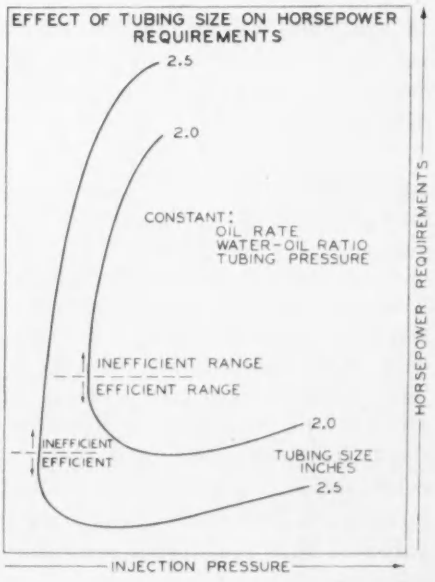


FIGURE 4.

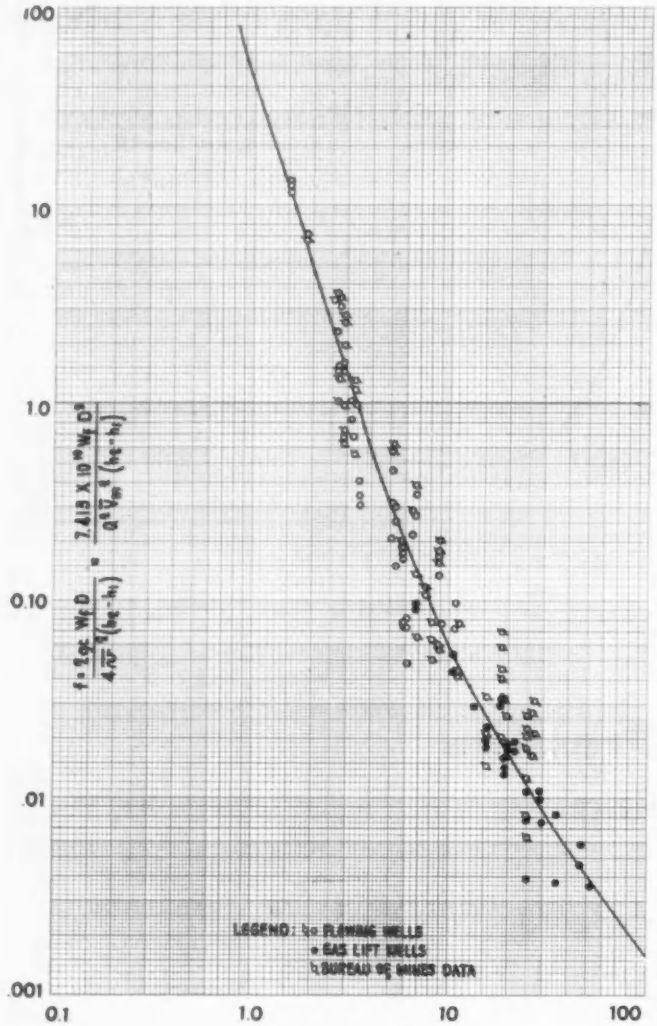


FIGURE 5. Correlation of field data on flowing and gas lift wells.

traverses above the point of gas injection are then calculated for different injection gas-oil ratios starting either with a given tubing pressure or injection pressure as illustrated by Figure 1. From these data, the ideal horsepower requirements, injection pressure, and depth of injection or tubing pressure for a given injection pressure can be determined for the different injection gas-oil ratios, when production rate and tubing size are held constant.

There are two possible ranges of operation in gas lifting. One is an inefficient range in which large quantities of gas are literally "blown" through the tubing. High gas-oil ratios and high compressor horsepower requirements result. The efficient range is characterized by low gas-oil ratios and low compressor horsepower requirements. A plot of gas-oil ratios versus injection pressure is shown in Figure 2. The efficient range is to the left of the minimum injection pressure and the inefficient range to the right.

A plot of ideal horsepower requirements to lift the oil versus injection pressure is shown in Figure 3. The horsepower required passes through a minimum value which represents the maximum efficiency of the lifting operation. The inefficient range is in the region above the horsepower value for the minimum injection pressure.

During the course of some field tests, it was shown that for a given rate of flow, 2-inch tubing was more efficient than 2½-inch or 3-inch tubing; whereas calculations showed that 2½-inch and 3-inch were more efficient on field data has an important advantage in that it is unnecessary to extrapolate the laboratory data to field conditions.

Application. There are many variables involved in making gas lift calculations, and the variation of any one will affect the others. As a result it is dangerous to attempt to draw general conclusions based on a few field observations as is very often done. The correlation provides a means of systematically studying the effects of the different variables upon one another, which is practically impossible in field work. Herein lies the greatest value of this new pressure traverse correlation.

In gas lift calculations, the pressure traverse below the point of gas injection is first determined. Various

About the Authors

FRED H. POETTMANN is senior section chief in charge of production research for Phillips Petroleum Company at Bartlesville, Okla. He received his BS degree in chemical engineering in 1942 from Case Institute of Technology, and his MS and ScD degrees in chemical engineering from the University of Michigan in 1943. He joined Phillips research staff in January, 1946 and has been engaged primarily in production research. He has taught graduate extension courses in chemical engineering through Oklahoma A. & M. Extension Service at Bartlesville, and has served as chemist for the AGA and a research chemist for the Lubri Zol Corporation.

F. H. Poettmann

PAUL G. CARPENTER is manager of the synthetic rubber branch, Research Division, Phillips Petroleum Company. He was formerly senior section chief in charge of production research. He attended elementary and high school in Salem, Oregon and received his undergraduate training at Willamette University, graduating with a BA degree in 1935. He obtained the MS degree in chemistry from Oregon State College in 1937 and in 1941 his PhD in chemistry at the University of Wisconsin. He joined Phillips in 1947. Previous to this, he was employed as a teaching and research assistant at the University of Wisconsin, assistant professor at Willamette University, and a research chemist and supervisor at the Hercules Powder Company.

P. G. Carpenter

cient for the particular conditions under consideration. This was due to the fact that field observations were made in gas lift wells operating in the inefficient range, and in this range, 2-inch is more efficient than 2½-inch or 3-inch. Figure 4 indicates the conditions described above.

The lower the tubing pressure can be maintained, consistent with efficient surface operations, the less will be the horsepower required to lift the reservoir fluids.

For flowing wells the correlation permits a straightforward calculation in determining bottom-hole pressure knowing surface data, pressure-temperature-volume properties of the flowing fluids, and an average flow string temperature. The pressure traverse is established by starting at the well head with a tubing pressure corresponding to surface production data.

Correlation. Having available production data and PVT data on a flowing or gas lift well along with a procedure for establishing f, a total energy loss correlating factor, the difference in elevation for a given pressure difference can be calculated from the generalized fluid flow equation. The total energy loss factor, f, is analogous to the friction factor used for the prediction of pressure drop in pipe for single phase flow. In order to establish the values of f as some function of the variables involved in the flow of oil, water, and gas in the tubing, the reverse calculation was made. This involved making use of field data in the form of production data, PVT data, and pressure and temperature traverses. Values of f were calculated from the field data and were found to correlate best as a function of the product of the inside diameter of the tubing and the mass velocity of the fluid flowing in the tubing, Figure 5. In terms of units obtained from field data:

$$1.4737 \times 10^{-5} \frac{MQ}{D} \qquad (1)$$

It will be noted that this corresponds to the numerator of the well-known Reynolds' number. The fact that viscosity is not one of the variables involved in the vertical multiphase flow is both fortunate and to be expected. This is due to the fact that

TABLE 1—Summary of Data

	Well No.	Tubing Size Inches	Barrels Oil Per Day	Total Gas-Oil Ratio Cu. Ft./Bbl.	Total Gas-Liquid Ratio Cu. Ft./Bbl.	Water Oil Ratio	Gravity Oil °API	Sp. Gr. Water	Gas Gravity	Tubing Pressure PSIA	Well or Injection Depth in Feet △h	Calculated Press Diff. △P Calc. PSIA	Observed Press Diff. △P Obs. PSIA	△P/△h PSI/Foot Calc.	△P/△h PSI/Foot Obs.	Deviation PSI/Foot	Deviation Percent
A. FLOWING OIL WELLS																	
U. S. BUREAU OF MINES	1	2.5	1101.6	342	....	....	44.1	....	1.151	271	4,155	1147	1175	0.276	0.283	+0.007	+ 2.5
	2	2.5	126.2	342	....	....	44.1	....	1.151	248	4,155	1221	1248	0.293	0.300	+0.007	+ 2.3
	3	3.0	988.8	342	....	....	44.1	....	1.151	198	4,136	1042	1064	0.252	0.257	+0.005	+ 1.9
	4	3.0	1432.8	342	....	....	44.1	....	1.151	189	4,136	1002	1031	0.242	0.249	+0.007	+ 2.8
	5	2.5	88.4	2588	....	....	47.1	....	0.741	2407	9,826	2293	2178	0.233	0.222	—0.011	— 4.9
	6	2.5	217.3	2502	....	....	47.1	....	0.756	2160	10,620	2240	2300	0.211	0.217	+0.006	+ 2.8
	7	2.5	71.7	5120	....	....	50.8	....	0.699	2440	9,385	1760	1580	0.186	0.168	—0.018	—10.7
	8	2.5	503.9	3025	....	....	50.8	....	0.680	2208	9,128	1641	1601	0.180	0.175	—0.005	— 2.9
	9	2.5	244.8	3640	....	....	50.8	....	0.680	2360	9,592	1790	1730	0.187	0.180	—0.007	— 3.9
	10	2.5	95.7	1866	....	....	45.5	....	0.742	1794	10,266	2213	2343	0.216	0.228	+0.012	+ 5.3
	11	2.5	313.2	2151	....	....	47.6	....	0.742	1784	10,683	2326	2531	0.218	0.236	+0.018	+ 7.6
	12	2.5	60.0	2250	....	....	44.4	....	0.796	1264	10,800	2562	2571	0.237	0.238	+0.001	+ 0.4
	13	2.5	447.0	940	....	....	42.4	....	0.797	1153	7,014	1877	1872	0.268	0.267	—0.001	— 0.4
	14	2.5	232.0	924	....	....	41.3	....	0.802	1154	6,987	1861	1840	0.266	0.263	—0.003	— 1.1
	15	2.5	302.0	936	....	....	42.3	....	0.816	860	6,850	1670	1670	0.244	0.244	0.000	0.0
	16	2.0	286.4	913	....	....	41.9	....	0.793	1100	6,930	1890	1845	0.273	0.266	—0.007	— 2.6
	17	2.5	279.9	920	....	....	42.2	....	0.796	1030	6,990	1823	1823	0.261	0.261	0.000	0.0
	18	2.0	82.0	3393	....	....	54.0	....	0.752	1645	7,450	1535	1655	0.206	0.222	+0.016	+ 7.2
	19	2.0	125.0	3393	....	....	54.0	....	0.752	1635	7,350	1385	1655	0.188	0.226	+0.038	+16.8
	20	2.0	480.0	3393	....	....	54.0	....	0.752	1455	9,620	1715	1910	0.178	0.199	+0.021	+10.5
PHILLIPS PETROLEUM CO.	21	2.5	146.4	500	....	....	38.7	....	1.0080	279	4,490	1201	1157	0.267	0.258	—0.009	— 3.5
	22	2.0	187.2	1019	....	....	38.8	....	0.9349	990	7,850	2275	2200	0.290	0.280	—0.010	— 3.6
	23	2.0	167.0	1245	....	....	42.0	....	0.8225	985	6,550	1650	1680	0.251	0.256	+0.005	+ 1.9
	24	2.0	138.0	1245	....	....	42.0	....	0.8225	665	6,570	1475	1890	0.225	0.288	+0.063	+21.9
	25	2.0	168.0	1747	....	....	42.6	....	0.8400	1261	7,800	1900	1880	0.244	0.241	—0.003	— 1.2
	26	2.0	259.2	1747	....	....	42.6	....	0.8400	1229	8,070	1970	1970	0.244	0.244	0.000	0.0
	27	2.0	91.2	1747	....	....	42.6	....	0.8400	1221	8,000	2180	2030	0.273	0.254	—0.019	— 7.5
	28	2.5	60.0	906	....	....	36.2	....	0.8225	555	6,500	1710	1770	0.263	0.272	+0.009	+ 3.3
	29	2.5	204.0	906	....	....	36.2	....	0.8225	345	6,500	1320	1605	0.203	0.247	+0.044	+17.8
	30	2.5	106.0	906	....	....	36.2	....	0.8225	455	6,500	1100	1180	0.169	0.182	+0.013	+ 7.1
	31	2.0	131.0	3588	....	....	43.9	....	0.8287	1665	8,480	1755	1595	0.207	0.188	—0.019	—10.1
	32	2.0	245.3	192	....	....	41.3	....	1.048	145	4,410	1090	1274	0.247	0.289	+0.042	+14.5
	33	2.0	160.3	189	....	....	41.3	....	1.048	175	3,000	735	908	0.245	0.303	+0.058	+19.1
	34	2.0	392.4	230	....	....	41.3	....	1.048	105	4,410	1085	1124	0.246	0.255	+0.009	+ 3.5
B. GAS LIFT WELLS																	
PHILLIPS PETROLEUM CO.	35	2.0	80.0	5,110	741	5.90	35.5	1.150	0.625	107	2,980	400	440	0.134	0.148	+0.014	+ 9.5
	36	2.0	68.0	4,776	451	9.06	35.5	1.150	0.625	155	2,850	425	425	0.149	0.149	0.000	0.0
	37	2.0	28.0	5,321	405	12.14	35.5	1.150	0.625	110	2,770	405	405	0.146	0.146	0.000	0.0
	38	2.0	14.0	15,857	434	35.60	36.0	1.076	0.650	105	3,461	510	555	0.147	0.160	+0.013	+ 8.1
	39	2.0	36.0	13,243	607	20.83	35.5	1.150	0.625	170	3,380	535	580	0.158	0.172	+0.014	+ 8.1
	40	2.5	18.0	18,333	1,586	10.56	36.0	1.076	0.650	115	3,376	323	273	0.0957	0.0809	—0.0148	—18.3
	41	2.0	10.6	40,849	781	51.32	38.1	1.074	0.650	180	3,222	435	455	0.135	0.141	+0.006	+ 4.3
	42	2.0	21.0	15,576	562	26.71	39.7	1.150	0.625	155	3,222	465	485	0.144	0.151	+0.007	+ 4.6
	43	2.0	5.2	34,808	607	56.38	38.1	1.074	0.650	122	2,780	350	355	0.126	0.128	+0.002	+ 1.6
	44	2.0	53.0	2,557	156	15.43	30.4	1.082	0.600	195	1,053	240	240	0.228	0.228	0.000	0.0
	45	2.0	43.0	1,105	31	34.37	30.4	1.082	0.600	85	1,273	435	370	0.342	0.291	—0.051	—17.5
	46	2.0	52.0	2,888	112	25.71	30.6	1.082	0.600	112	1,248	332	342	0.266	0.274	+0.008	+ 2.9
	47	2.0	66.0	1,258	80	14.74	30.4	1.082	0.600	112	1,257	338	348	0.269	0.277	+0.008	+ 2.9
	48	2.0	38.6	8,233	719	10.45	34.4	1.074	0.650	132	3,657	490	456	0.134	0.125	—0.009	— 7.2
	49	2.0	49.1	8,890	801	10.10	34.8	1.074	0.662	111	3,646	505	464	0.139	0.127	—0.012	— 9.4

Algebraic Average Deviation..... +1.8 percent
Standard Deviation from Algebraic Average, σ..... 8.3 percent

the degree of turbulence is of such magnitude that of the total energy loss, W_f, that portion due to viscous shear is negligible.

In order to establish an idea of the deviation of the calculated results from field measurements Figure 6 was drawn. It shows a plot of the calculated versus field measured over-all gradient. ΔP is the difference between the flowing bottom-hole pressure and the tubing pressure and Δh is the well depth. In the case of gas-lift wells ΔP is the difference between injection pressure at the point of injection into the flow string and the tubing pressure, and Δh is the depth at which the gas is injected. Deviations are to a large extent indicative of the accuracy of the data used. This can be seen when comparing the Bureau of Mines data with the Phillips Petroleum Company data, which were taken for purposes other than as used in this study. The algebraic average deviation for the 49 wells shown was +1.8 percent and the standard deviation, σ, from the algebraic average was 8.3 percent. For the Bureau of Mines data the algebraic average deviation was also +1.8 percent, but the standard deviation, σ, from the algebraic average was 5.8 percent, whereas for the Phillips data although the algebraic average was also +1.8, the Phillips' σ was 9.5 percent. The Bureau of Mines data have a much narrower spread than the Phillips data. The algebraic average deviation represents the bias of the correlation. For a normal distribution, 68.26 percent of the values will be included within plus or minus one standard deviation, 95.46 percent within plus or minus two standard deviations, and 99.73 percent within plus or minus three standard deviations.

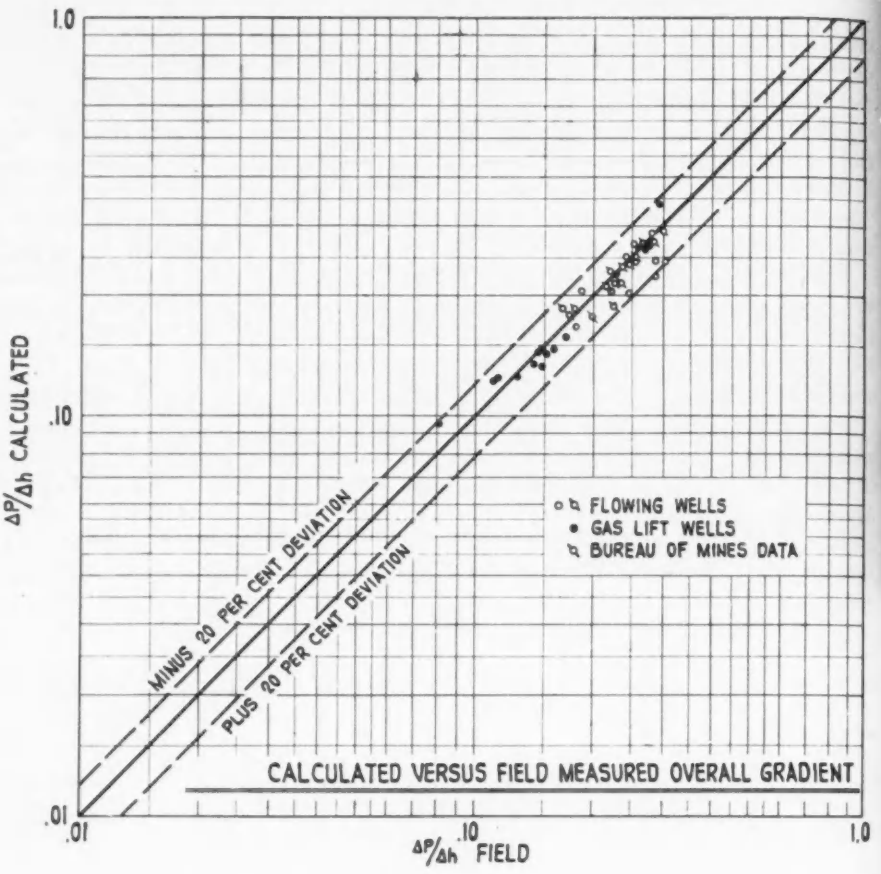


FIGURE 6.

Table 1 summarizes some of the data employed in the correlation shown in Figure 5. The correlation is based on wells having 2, 2½, and 3-inch nominal size tubing diameters, gas-liquid ratios up to 5000 cubic feet per barrel of total liquid, rates from 60 barrels to 1500 barrels of total liquid per day, water-oil ratio up to 56, oil gravities from 30 to 54 degrees API, and well depths to 11,000 feet. The correlation should be used only for the multiphase flow of gas and liquid through vertical tubing. It should not be extended to flow through casing sizes or to flow involving very high gas-oil ratios. Any reasonable solution to a problem will depend upon accurate and reliable field data. In the case of gas-lift calculations the correlation is most reliable in the region of gas-liquid ratios of 1000 or less.

How to Use the Correlation. The correlation is used in the same manner as the f factor plots for single phase flow. Flow data are used to obtain the energy loss factor, f, from the correlation. The f factor, which is a

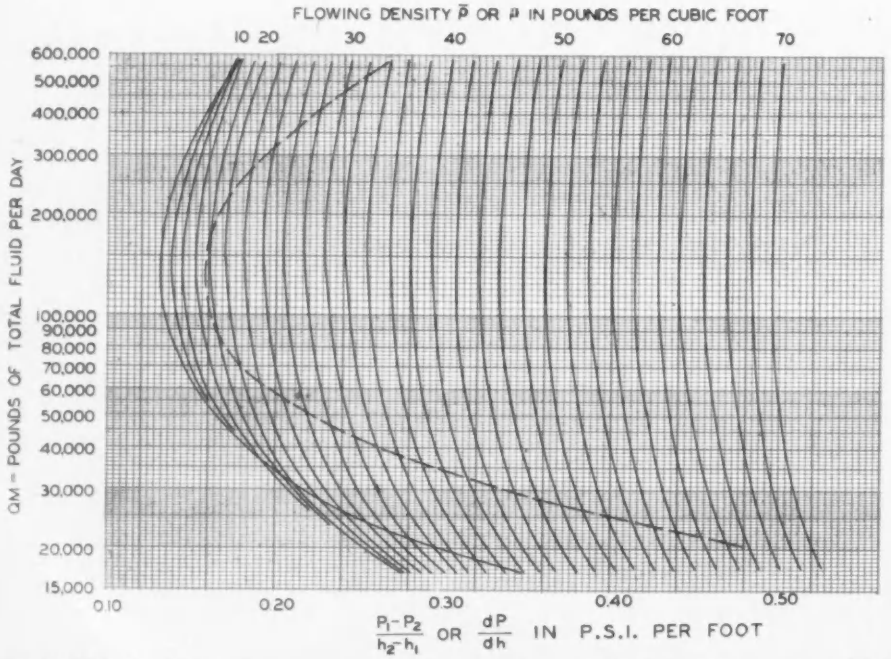
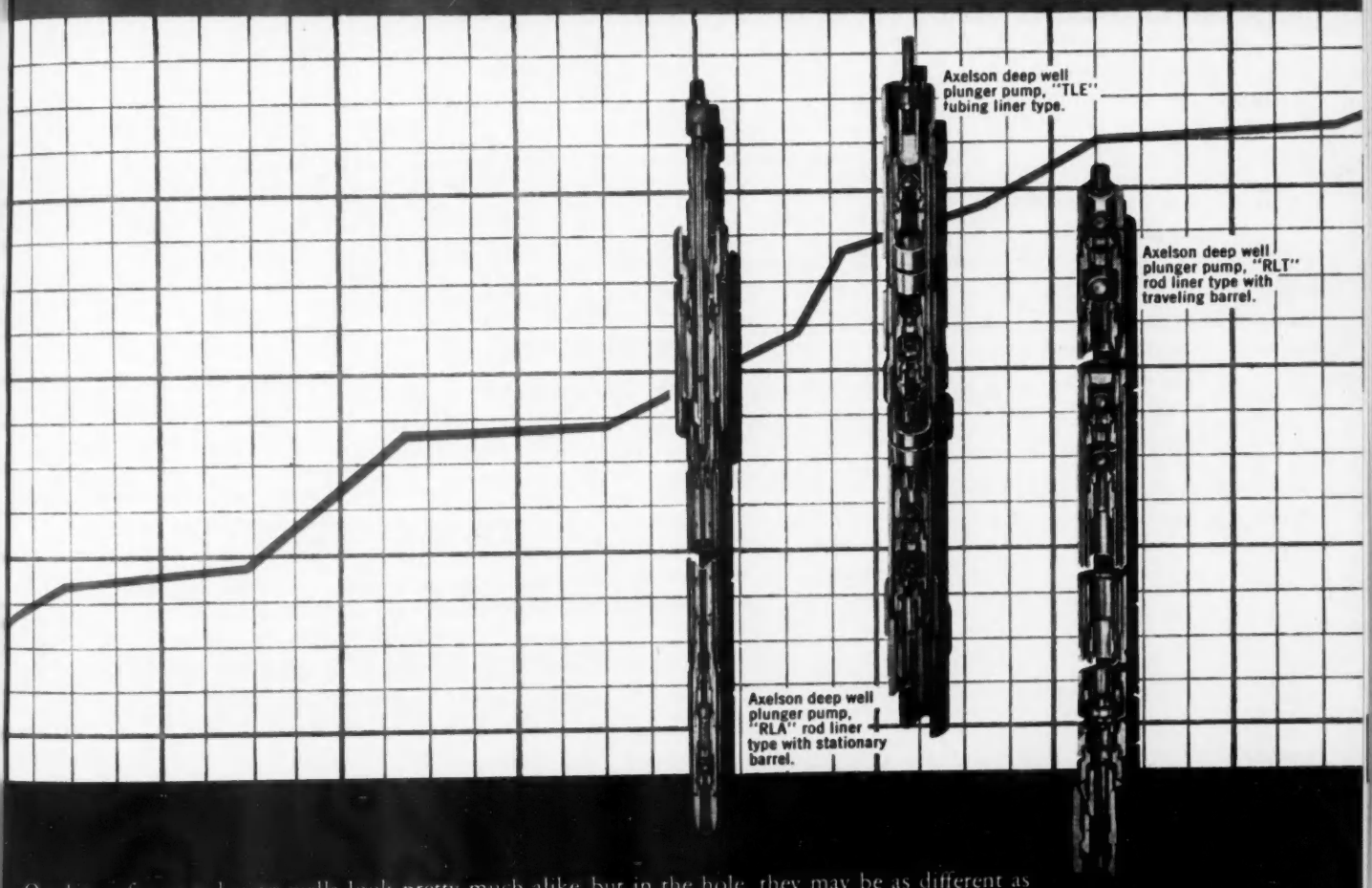


FIGURE 7. Calculation of pressure traverses for nominal size 2-inch (4.5-4.7 lbs. per foot, 1.995 inches ID) tubing size.

INCREASE YOUR

b/d

WITH AXELSON DEEP WELL PLUNGER PUMPS


Axelson deep well plunger pump, "TLE" tubing liner type.
Axelson deep well plunger pump, "RLT" rod liner type with traveling barrel.
Axelson deep well plunger pump, "RLA" rod liner type with stationary barrel.

On the surface, producing wells look pretty much alike, but in the hole, they may be as different as day and night. That's why Axelson, with its more than 60 years experience, is meeting production problems with a wide range of pumping equipment designed to answer any specific well condition, from normal to adverse. That's why an Axelson expert is readily available to analyze your pumping problem and make specific recommendations for the *correct* Axelson deep well plunger pump. These men are saving operators thousands of dollars in needless down-time, caused by failure of incorrectly specified equipment. If you are having trouble or are simply in doubt about the suitability of the equipment you are using, we urge that you call your nearby Axelson expert.

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

AXELSON

Chosen first ... to last!

PETROLEUM PUMPING EQUIPMENT PSC

AXELSON MANUFACTURING COMPANY • Division of Pressed Steel Car Company, Inc. • PLANTS: Los Angeles 58, California • St. Louis 16, Missouri • OFFICES: New York 7, New York • Tulsa 1, Oklahoma • Buenos Aires, Argentina. DISTRIBUTORS: Jones & Laughlin Supply Co.; Great Northern Tool & Supply Co.; Industrial Agencies, Ltd., San Fernando, Trinidad, B. W. I.; Industrias Waldrip & Campbell, Barcelona, Caracas and Maracaibo, Venezuela; South American Supply Co., Ltd., Lima, Peru; Sociedad Comercial de Materias Primas Limitado, Rio de Janeiro, Brazil; G. Saavedra e Hijos, S. de R. L., Avenida Morelos 31, Mexico, D. F.; Dominion Oil Field Supply Co., Ltd., Calgary, Canada

dimensionless group, includes the energy losses term, W_f. Ability to evaluate W_f permits an energy balance between two points in a string of tubing. By making the energy balance, pressures and corresponding depths can be determined. Included under "Theoretical Development of Correlation" is Equation 5 which relates depth, pressure, f, and the other variables involved in multiphase fluid flow. Pressure traverses can be calculated directly by this equation using Figure 5.

To simplify the calculations Figures 7, 8 and 9 were constructed for given tubing sizes by combining the f factor data of Figure 5 and Equation 5. On the vertical axis is plotted the product of Q and M which is equivalent to the pounds of fluid (oil, water, and gas) flowing per day. On the horizontal axis is plotted

$$\frac{P_1 - P_2}{h_2 - h_1} \text{ or } \frac{dP}{dh}$$

in units of pounds per square inch per foot of depth. The curves plotted on the diagram are for constant integrated average density, $\bar{\rho}$, between the pressures P_1 and P_2 or density, ρ, corresponding to a given pressure P. Values of $\frac{P_1 - P_2}{h_2 - h_1}$ correspond to values of $\bar{\rho}$ and values of $\frac{dP}{dh}$ to ρ.

The integrated average value of density, $\bar{\rho}$, can be calculated from the expression

$$\bar{\rho} = \frac{M}{\bar{V}_m} \qquad (2)$$

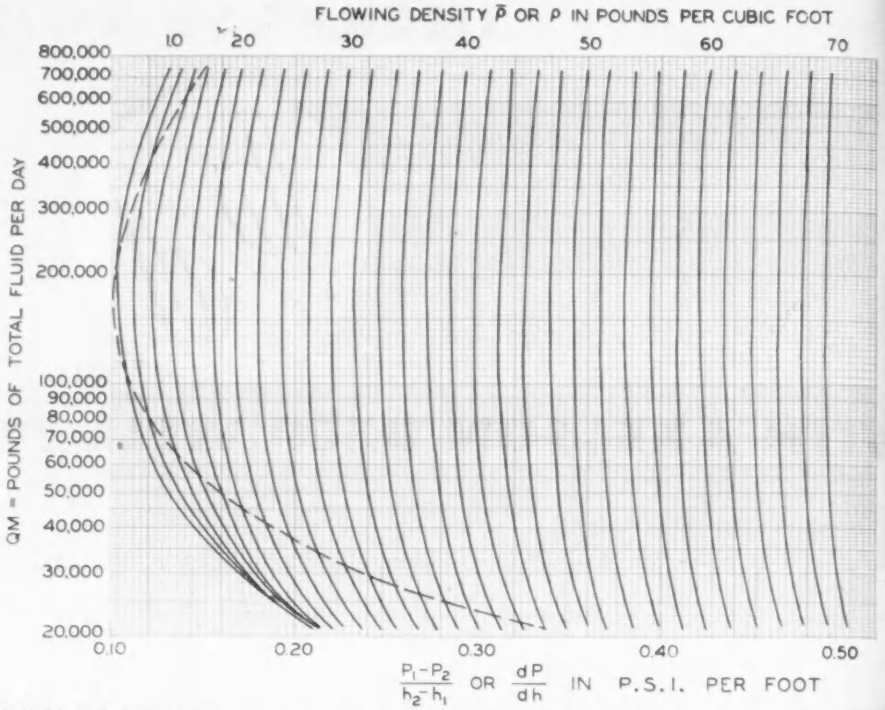


FIGURE 8. Calculation of pressure traverses for nominal size 2.5-inch (6.25-6.5 lbs. per foot, 2.441 inches ID) tubing size.

and the density, $\bar{\rho}$, corresponding to a given pressure P by

$$\rho = \frac{M}{V_m} \qquad (3)$$

By determining the density at any pressure, $\frac{dP}{dh}$ can be evaluated for that pressure. Plotting the reciprocal of $\frac{dP}{dh}$ versus the pressure and integrating, the pressure traverse can be established. Another procedure for establishing the pressure traverse is to determine the integrated average density, $\bar{\rho}$, between the pressure limits P_1 and P_2, $\frac{P_1 - P_2}{h_2 - h_1}$ can then be determined. Dividing this value of $\frac{P_1 - P_2}{h_2 - h_1}$ into $P_1 - P_2$, the limits used in evaluating $\bar{\rho}$, the difference in elevation between these pressure limits is determined. In this manner the complete pressure traverse can be constructed.

The curves are useful in other ways as well as simplifying the rigorous calculation of the pressure traverse. For example, in the case of a flowing well for which the pressure traverse is available the value of $\bar{\rho}$ between two pressures P_1 and P_2 may be evaluated from the traverse and flow rate. Assuming that this flowing density is not going to change with flow rate, a new pressure traverse can be estimated at a different rate of flow. These curves can also be used to estimate the minimum depth necessary at which to inject gas for a fixed rate of fluid production.

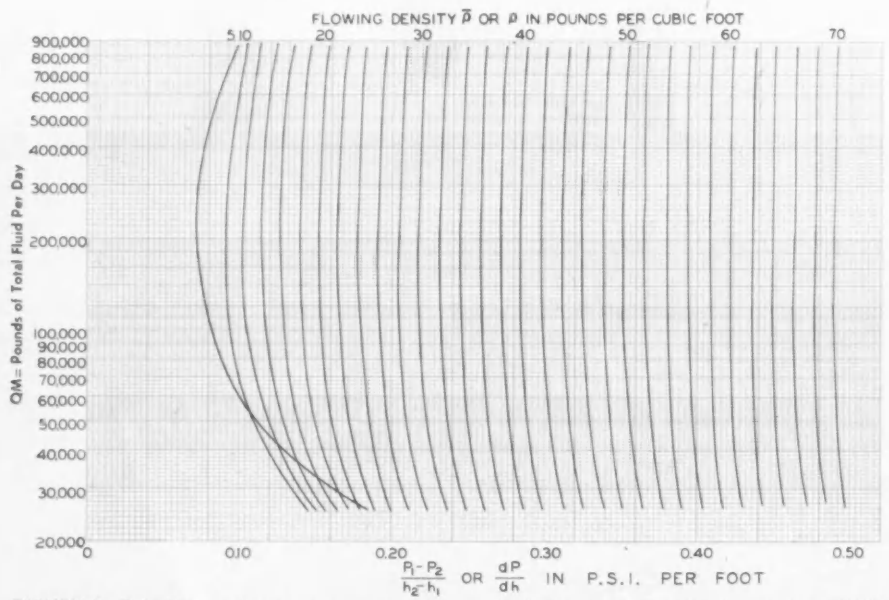
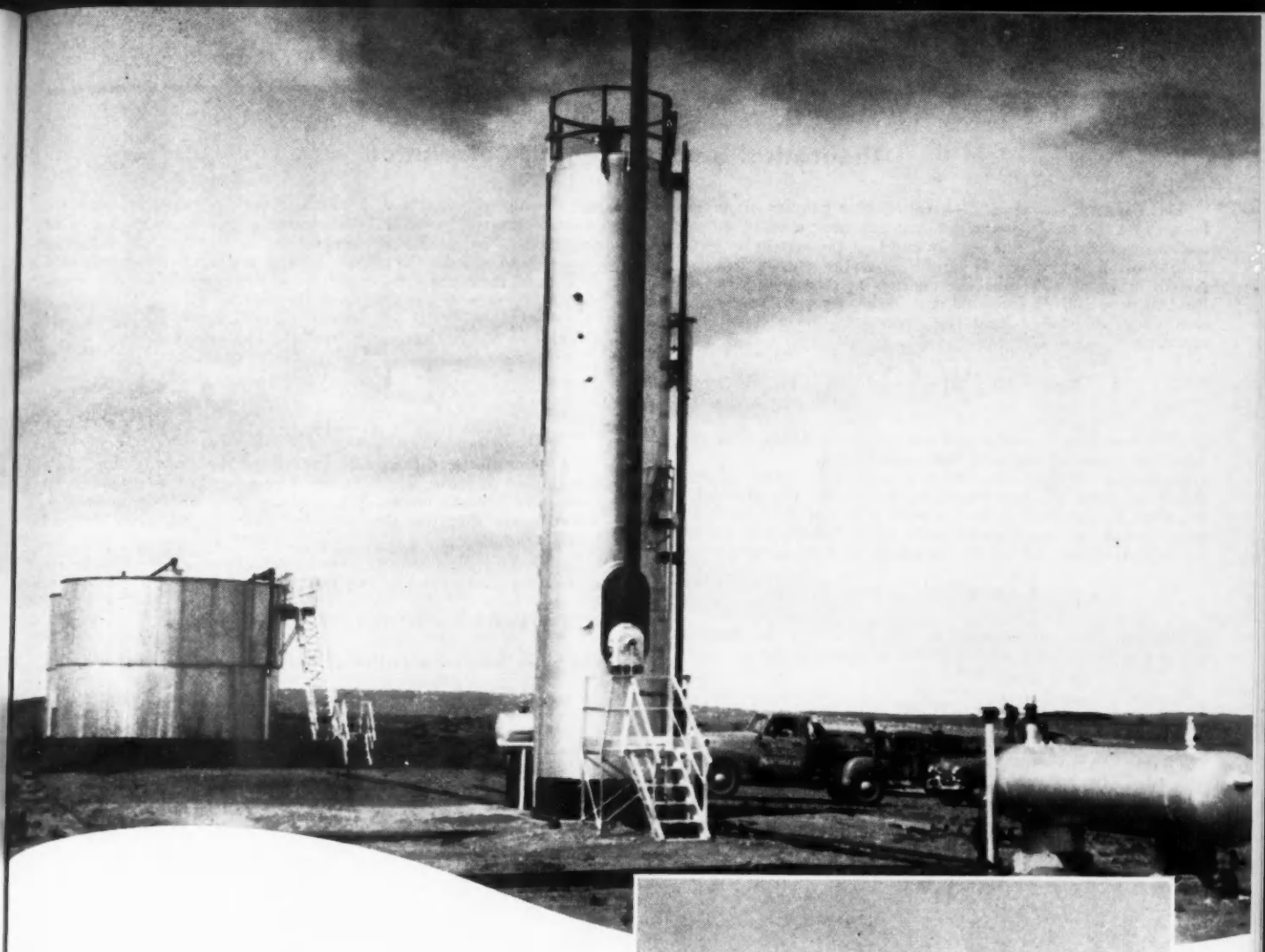


FIGURE 9. Calculation of pressure traverses for nominal size 3-inch (7.694 lb. per foot, 3.068 inches ID) tubing size.

NOMENCLATURE

V = Specific volume of flowing fluid in cubic feet per pound.
P = Absolute pressure in consistent Units.
h = Height above datum plane in feet.
v = Velocity of flowing fluid in feet per second.
g_c = Constant = 32.174.
W_s = Work done by the fluid while in

■ CONTINUED ON PAGE 175
(Theoretical development of correlation on next page.)



NATIONAL SERVING PRODUCERS IN THE WILLISTON BASIN AREA

One of the newer and most active areas in America is now well on its road to complete definition as a great American Oil Field.

National customers have found National ready, able and willing, as usual, with a large stock of supplies and top flight service to care for their every need! National again expresses its pleasure in its ability to perform these services and appreciates the confidence expressed by those customers.

You will find National stocks and services as near as your telephone, anywhere.

It's a National

NATIONAL TANK COMPANY

TULSA, OKLAHOMA

2-2-53

Theoretical Development of Correlation

The basis of any fluid flow calculation consists of an energy balance on the fluid flowing between any two points of the system under consideration. The energy entering the system by virtue of fluid flowing at point (1) must equal the energy leaving the system at point (2) plus the energy interchanged between the fluid in flow and its surroundings. This energy balance based on one pound of flowing fluid is expressed by the well known flow equation.

$$\int_{P_1}^{P_2} VdP + \Delta h + \Delta\left(\frac{v^2}{2g_c}\right) + W_f + W_s = 0 \qquad (1)$$

This equation contains no limiting assumptions and can be made the basis of any fluid flow relationship.

Assuming homogeneous steady flow of the mixture of gas and liquid between any two points in the tubing, the external work W_s done by the fluid in flow is zero. Value of the kinetic energy function is small as compared to the other functions in the energy balance equation and can be neglected. This then leaves:

$$\int_{P_1}^{P_2} VdP + \Delta h + W_f = 0 \qquad (2)$$

Assuming that the energy losses W_f for multiphase flow can be correlated by the well known Fanning equation, then:

$$f = \frac{2g_c W_f D}{4\bar{v}^2 \Delta h} \qquad (3)$$

Where f is used in this development as the correlating function for total energy loss, whether due to friction or otherwise. Velocity $\bar{v}$ is assumed constant and equal to the integrated average value between pressure limits P_1 and P_2.

By substituting and rearranging Equation 2 and 3 assuming $\bar{v}$ constant,

$$\Delta h = \frac{\int_{P_2}^{P_1} VdP}{1 + \frac{4\bar{v}^2 f}{2g_c D}} \qquad (4)$$

In terms of units readily obtained from field data:

$$\Delta h = \frac{\frac{1}{M}\int_{P_2}^{P_1} V_m dP}{1 + \frac{fQ^2\bar{V}^2_m}{7.413 \times 10^{10} D^5}} \qquad (5)$$

Volume V_m associated with one barrel of stock tank oil can be calculated from a knowledge of the formation volume factor of the oil, the gas solubility in the oil, the producing gas-oil ratio and the producing water-oil ratio:

$$V_m = 5.61F + \frac{P_s T_{avg} Z}{P T_s}(S_{g/o} - S_s) + V_w \qquad (6)$$

Quite often the formation volume factor and gas solubility are straight line functions of pressure over the range of pressure under consideration. If this is the case V_m can be calculated as follows:

$$V_m = 5.61\, n_f P + 5.61\, F_i + \frac{P_s T_{avg} Z}{T_s}\left(\frac{S_{g/o}}{P} - n_s - \frac{S_i}{P}\right) + V_w \qquad (7)$$

Total mass of flowing fluid associated with one barrel of stock tank oil can be calculated from the following expression:

$$M = (5.61)(62.4)(G_{sto}) + (0.0764)(G_g)(S_{g/o}) + (62.4)(G_b)(V_w) \qquad (8)$$

In establishing the value of the term $\int_{P_2}^{P_1} VdP$ of Equation 4 or $\int_{P_2}^{P_1} V_m dP$ of Equation 5, V or V_m is plotted versus the absolute pressure and the area under the curve between the pressure limits P_1 and P_2 determined either mathematically or graphically. In graphical integration it is often of sufficient accuracy to divide the curve into a series of trapezoids and determine their areas by multiplying their width by the arithmetical average of the length of the two sides.

Value of $\bar{V}_m$ is determined from the expression

$$\bar{V}_m = \frac{\int_{P_2}^{P_1} V_m dP}{P_1 - P_2} \qquad (9)$$

In determining the specific volume of the flowing fluid as a function of pressure, the most accurate procedure is to use direct laboratory measurements. When these data are not available, resort must then be made to formation volume factor and solubility data.

If the formation volume factor and gas solubility can be expressed as a straight line function of pressure over the range of pressure under consideration, value of the integral $\int_{P_2}^{P_1} V_m dP$ can be determined analytically. By substituting the value of V_m of Equation 7, $\int_{P_2}^{P_1} V_m dP$ can then be written as follows:

$$\int_{P_2}^{P_1} V_m dP = 5.61\, n_f \int_{P_2}^{P_1} PdP + 5.61\, F_i \int_{P_2}^{P_1} dP + \frac{P_s T_{avg} S_{g/o}}{T_s} \int_{P_2}^{P_1} \frac{Z}{P} dP - \frac{P_s T_{avg} n_s}{T_s} \int_{P_2}^{P_1} ZdP - \frac{P_s T_{avg} S_i}{T_s} \int_{P_2}^{P_1} \frac{Z}{P} dP + V_w \int_{P_2}^{P_1} dP \qquad (10)$$

Integrating and collecting common terms we obtain:

$$\int_{P_2}^{P_1} V_m dP = 2.805\, n_f (P_1^2 - P_2^2) + (5.61\, F_i + V_w)(P_1 - P_2) + \frac{P_s T_{avg}}{T_s}\left[(S_{g/o} - S_i)\int_{P_2}^{P_1} \frac{Z}{P} dP - n_s \int_{P_2}^{P_1} ZdP\right] \qquad (11)$$

The integrals involving the compressibility factor of the natural gas can be evaluated in terms of the pseudo reduced pressure.

$$\int_{P_2}^{P_1} \frac{Z}{P} dP = \int_{P_{r_2}}^{P_{r_1}} \frac{Z}{P_r} dP_r = \left[\int_{0.2}^{P_{r_1}} \frac{Z}{P_r} dP_r - \int_{0.2}^{P_{r_2}} \frac{Z}{P_r} dP_r\right] \qquad (12)$$

and

$$\int_{P_2}^{P_1} ZdP = P_c \int_{P_{r_2}}^{P_{r_1}} ZdP_r = P_c\left[\int_{0.2}^{P_{r_1}} ZdP_r - \int_{0.2}^{P_{r_2}} ZdP_r\right] \qquad (13)$$

Where: $P_r = \frac{P}{P_c}$

$dP_r = \frac{dP}{P_c}$

P_c = Pseudo critical pressure

By arbitrarily setting a lower pressure limit of P_r of 0.2, values of $\int_{0.2}^{P_r} \frac{ZdP_r}{P_r}$ and $\int_{0.2}^{P_r} ZdP_r$ can be determined as functions of pseudo reduced pressure and temperature. Tables of these functions have been prepared. These tables along with Equations 12 and 13 make it possible to evaluate the value of $\int_{P_2}^{P_1} V_m dP$ from Equation 11 directly without resorting to graphical integration.

JONES SUCKER RODS

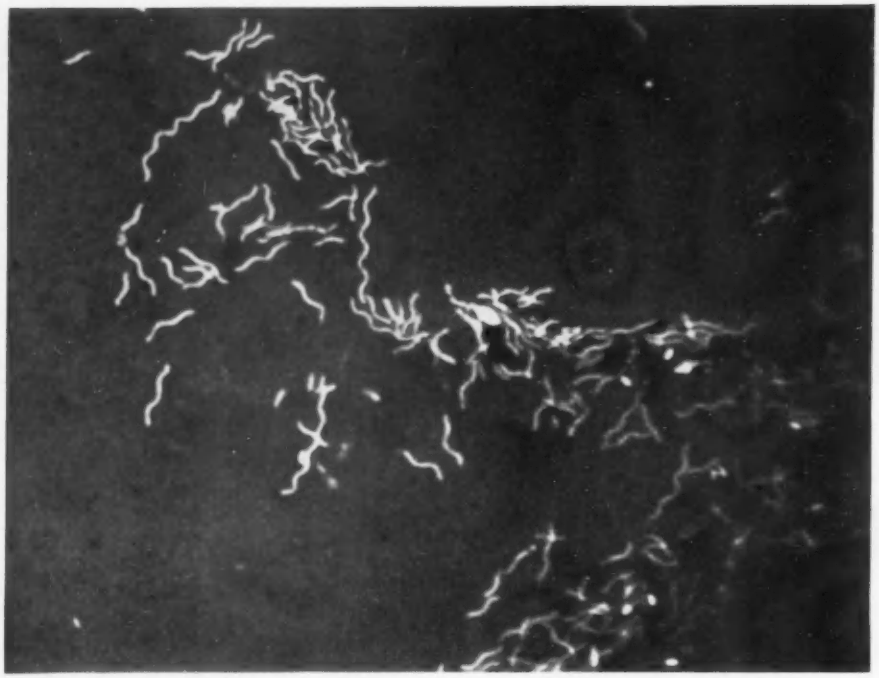
Endurance and uniformity are added to all Jones Sucker rods by controlled full length normalizing. Forging strains and heat demarcations are removed. Grain structure is refined.

Physicals of Jones nickel alloy rods are improved by both normalizing and tempering.

PESA
PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION
PARTNERS IN PETROLEUM PROGRESS

THE S. M. JONES COMPANY
Division of Buffalo-Eclipse Corporation
General Office and Factory: TOLEDO, OHIO
Sales Office: Kennedy Building, Tulsa, Okla.
Export Sales Office: Buffalo International Corp.
50 Church Street, N. Y. C.

LOOK FOR THE GREEN RODS



Photomicrograph of sulfate reducing bacteria cells (magnified 1660 times) that cause plugging and corrosion in handling oil field waters. Technical name of these cultures is sporovibrio desulfuricans. (Photo reproduced through courtesy of Dr. R. L. Starkey, Rutgers University, New Brunswick, N. J.)

Little Bugs . . . . . Big Problems

Here's an investigation into the causes and effects of the presence of sulfate reducing bacteria in oil field waters . . . and what can be done about it.

By DR. O. B. WILLIAMS
Professor of Bacteriology, University of Texas, Austin

COSTLY TREATMENTS to restore original porosity to formations into which salt water is injected for flooding or disposal purposes can be reduced substantially by controlling the growth of sulfate-reducing bacteria so prevalent in oil field waters. These minute organisms reduce traces of sulfate to insoluable sulfides that tend to plug porous formations receiving the water. Numerous isolations from water produced from oil reservoirs indicate the widespread presence of the organisms. Even if not naturally present, their almost universal occurrence in nature would quickly lead to a presistent contamination of the water treating system.

Growth of the organisms leads to the formation of insoluble sulfides, sometimes in considerable amounts, which imposes a heavy load on the clarifying system. Residual and freshly formed sulfide may eventually result in plugging the underground structure to such an extent as to make necessary costly and time-consuming workovers to clean the formation, and to even require a new injection well. Controlling the growth of these bacteria according to customary water treatment procedures generally has not been successful.

From another practical standpoint, a major interest in sulfate reduction is because of the corrosion of buried metal. Anaerobic corrosion is of major economic importance wherever iron or steel is exposed to a moist anaerobic environment at a favorable temperature. The process has been observed over a long period of time, but its microbiological nature was not recognized until 1934.[4]

Bacteria Distribution. Bacteria which reduce sulfate are widely and abundantly distributed in nature, probably to such an extent that sulfate reduction is one of the most common chemical changes due to bacterial activity. Such bacteria have been isolated from a great many land sources in many countries and from ocean mud from all water depths which have been cultured. Despite the wide occurrence of the organisms and the diverse nature of the conditions from which they have been isolated, there are not many bacteriological types, possibly only one, which can bring about the reaction. There is scarcely enough information yet available to justify a positive statement on this point.

Organisms which have been found by various investigators to be concerned in sulfate reduction have been anaerobic, that is, they require a highly reduced environment, growing only in the absence of free oxygen. They will grow in fairly simple nutrient solutions, provided sulfate, and iron in at least trace amounts, are present. They are able to use a wide variety of organic materials for energy in support of growth, and have recently been found to be capable also of obtaining energy for growth from the oxidation of the small amount of hydrogen evolved from the reaction between metallic iron and water of the medium in which they are cultivated. They are tolerant of considerable differences in environment. Organisms from a saline environment grow preferentially in the presence of about three percent salt, or in media prepared with sea water. Some cultures grow best at temperatures as high as 110 to 120° F, and with some

New CARLON "L" PLASTIC PIPE

GIVES GREATEST RESISTANCE TO CORROSION • PARAFFIN BUILD-UP • FLUID FRICTION

Carlon "Mirror Finish" . . . . .

For the best buy in oil country pipe... check the advantages of new CARLON "L." This new pipe brings all of the features of lightweight and corrosion resistance, *plus* the added advantage of permanent free-flow and resistance to paraffin build-up.

Only CARLON "L" provides a mirror-like interior wall which assures continued flow characteristics and minimum power loss because of friction.

Check the features of CARLON "L"... check the advantages of CARLON "L." Write today for complete information... our field engineers will cooperate in solving your piping problems.

SPECIFY CARLON "L"... *Buy the Pipe with the Stripe!*

CARLON PLASTIC PIPE SAVES YOU TIME AND MONEY

TRANSPORTATION... Because of its extreme light weight *(only one-eighth as much as steel)*, more footage of CARLON "L" can be moved at less cost.

LAYING... CARLON "L" is easier and quicker to string... and connections are fast. CARLON "L" costs less to lay.

LONG LIFE... CARLON "L" provides permanent resistance to electrolytic corrosion, alkalies and sour crudes. CARLON "L" provides you with a permanent system.

GREATER FLOW... CARLON'S smooth internal wall finish, together with the superior flow characteristics of plastic pipe, make this new pipe outstanding for oil country applications.

CARLON PRODUCTS Corporation

10225 MEECH AVE. ■ CLEVELAND 5, OHIO

Sold Through Your Nearest Supply Store, or

GREEN CONTRACTING & ENGINEERING CO.

PETROLEUM BUILDING ■ WICHITA 2, KANSAS

EXCLUSIVE OIL COUNTRY DISTRIBUTOR

growth as high as perhaps 140 to 150° F; others show their best growth at from 75 to 85° F. Differences in conditions for good growth do not necessarily indicate fundamental biological differences among the organisms which have been studied, but may be no more than an expression of an adaptation to special conditions in nature. Extensive bacteriological study of cultures from different sources is needed, both for academic and practical reasons.

Bacteria Unique. These bacteria are unique in that they are the only living organisms which have the ability to reduce sulfate to sulfide. This activity has both theoretical and practical interest. It is possible that some of the deposits of elemental sulfur and of metallic sulfide ores are the result of their activity in past ages, and data of Jankowski and Zobell[2] suggest they may have had a part in the formation of petroleum.

Many investigators who have studied sulfate reducing bacteria have made the primary cultures in media containing an organic source of sulfur as well as sulfate. However, the production of hydrogen sulfide from organic sulfur-containing nutrients under anaerobic conditions is a characteristic of a number of bacteria. Since the work here discussed was directed toward the detection of sulfate reducing bacteria as they occur in association with many other types of bacteria, it was highly desirable that any sulfide noted should have been derived exclusively from sulfate.

Media used in exploratory experiments were, therefore, mineral solutions containing only sulfate as a possible source of sulfide. Shortly after the start of the work the report by Sisler and Zobell[3] appeared, and the medium described by them was promptly compared, both with and without neopeptone and yeast extract, with the medium being tested. One series of experiments included also a medium containing peptone and sodium thioglycollate to aid in maintaining a reduced environment. Later at the suggestion of R. C. Allred[1] of Phillips Petroleum Company, 1 percent sodium chloride was added to all media with distinctly beneficial results as measured by the time required for cultures to develop, and the vigor of growth. A modification by Allred of the Sisler and Zobell medium in which neopeptone is omitted and cystine, ferrous sulfate, sodium chloride and sodium thioglycollate are added, was compared with the Sisler and Zobell medium without an organic sulfur source. In all cases the inocula have been oil field brines, mostly from the East Texas field. Use of brine with the heterogeneous and variable bacterial flora which it carries limits the data suitable for comparison to a few experiments with each medium or under each variable condition. Attempts to isolate pure cultures to provide a standard inoculum have not been successful as yet, an experience which is in accord with statements in the literature. In numerous instances no growth was obtained in transplants made from primary cultures, but this difficulty has been largely overcome by using a more complex, and presumably more productive, medium for maintenance of transplants.

About the Author

DR. O. B. WILLIAMS is chairman of the Department of Bacteriology, the University of Texas, Austin. He received his BA and MA degrees from the University of Texas, and his Ph.D from the University of California in 1928. Work in bacteriology includes the U. S. Army Laboratory Service from 1917 to 1919; city water bacteriologist, Austin, 1921 to 1923; and bacteriologist, Research Laboratory, National Canners Association, Washington, D. C., 1935 to 1941. He began as an instructor in 1922 at the University of Texas and was appointed a professor in 1941. He is on the editorial board of the *Journal of Bacteriology* and has served on many committees concerning bacteriology.

Inoculation Tests. There was some belief that the results to be secured might be affected if the brine was not inoculated promptly after collection, since the oxygen tolerance of the organism was not known, and it was considered possible that holding the brine for a day or more before inoculation might injure the growth potential. Conceivably, growth might take place in the brine and results would indicate a heavier contamination than really existed. Accordingly, the first series of tests after the orientation experiments included on-the-spot inoculation of test media, and laboratory inoculation from the same brine sample at later intervals to determine whether reliable results required immediate inoculation. Results showed conclusively that field inoculation was not required. It has been possible to secure comparable quantitative data over a period of several weeks from a single sample.

Brines collected at a collecting tank and from heaters were tested for organisms growing at elevated temperatures with negative results. Some brines may contain these thermophilic types. But field observations did not suggest that they were a factor in sulfide formation in the East Texas area from which most of the samples examined have been collected. Accordingly, the inoculated media have been incubated at room temperature in all except the first few exploratory experiments. The cultural results which have been obtained can best be given in general statements, rather than in detail.

Growth ordinarily appeared in from 3 or 4 days at a minimum, to about 7 to 10 days as a maximum, in the mineral solution media. The organisms develop in the medium suggested by Allred faster than in other media tested, usually attaining a maximum count some 2 to 4 days earlier. Total number detected by this medium has been, however, essentially the same as that shown by the Sisler and Zobell medium without neopeptone and yeast extract, but with 1 percent sodium chloride. In this latter medium there can be no question that the ap-

pearance of sulfide is the result of sulfate reduction. This fact has been considered to overcome the advantage of quicker growth. Accordingly, for routine culturing of samples the mineral solution medium is now used exclusively.

Tests have been made comparing liquid medium and the same medium solidified with agar. There seemed to be no advantage of the liquid medium over the solid. Quantitative determinations are more readily made by the use of a solid medium and since information as to the number of sulfate reducers present was of prime interest in many tests, the solid medium has been regularly used.

Surface Active Agents. Much of the work has been concerned with tests of the sensitivity of the sulfate reducing bacteria to surface active agents. All tests were made by adding the surface active agent in sufficient amount to yield the appropriate end concentration in the mixture of medium and brine. Later at the suggestion of Allred screening tests were made by adding to the brine: calcium lactate, 0.35 percent, yeast extract 0.1 percent, L-cystine 0.01 percent, and sodium thioglycollate, 0.01 percent. The surface active agent being tested was then added to give appropriate end concentrations, the tubes incubated and observations made at closely spaced intervals. This procedure gives only qualitative results. In most of the work chief interest has been on quantitative results, a fact which necessitates the use of a solid medium, and a lighter inoculum than is provided in the use of the brine as the liquid portion of the medium. The standard screening procedure has been to inoculate several lots of tubes containing 20 milliliters of sterile liquified mineral solution agar, each lot containing the appropriate amount of agent with 1 milliliter of brine, incubate and at intervals make colony counts. In this way it has been possible to get excellent evidence of the increasing inhibitory effect of increasing the concentration of the agent in steps of 5 parts per million. With concentrations of agent just barely short of the amount necessary for complete inhibition delayed growth up to as long as two weeks has been noted.

In a field test in East Texas in which rather accurate quantitative data were desired, bottles containing 180 ml of medium were inoculated in lots with 0.5, 1 and 5 ml of brine. Reliability of the procedure was indicated by good agreement among bottles inoculated with equal amounts of brine, and in counts per ml of brine, as calculated from the different sized inocula. Inhibitory effect of the agent being tested was evident by the decrease in count following the start of treatment, and the inverse relationship between count and concentration of agent.

Although many products have been included in comparative testing, most of the tests have been made with surface active agents and include anionic, cationic, and noninonic preparations.

In retrospect the experience with laboratory and field testing leads to a strong conviction that a survey of a system being considered for treatment should be made by a competent engineer, in cooperation with a bacteriologist, bacteriological laboratory screening tests of effectiveness of several agents should be made to allow selection of the one best suited for the system, and periodic bacteriological check tests should be made.

Not all agents are effective against the sulfate reducers, and no one is equally suitable for use under all conditions. Experience with other bactericidal agents, both in the laboratory and in the treatment of infection shows that organisms may increase in tolerance to such an extent that an agent loses effectiveness. It is not possible to say whether sulfate reducing bacteria will behave in this way toward surface active agents. Possibility that they may speaks for periodic laboratory checks.

REFERENCES

[1] Allred, R. C., Personal communication.

[2] Jankowski, Gregory J., and Zobell, Claude E., Hydrocarbon Production by Sulfate-Reducing Bacteria, *Jour. Bact.*, vol. 47, p. 447, 1944.

[3] Sisler, Frederick D., and Zobell, Claude E., Hydrogen Utilization by Some Marine Sulfate-Reducing Bateria, *Jour. Bact.*, vol. 62, pp. 117-127, 1951.

[4] von Wolzogen Kuhr, C. A. H., and van der Vlugt, I. S., The Graphitization of Cast Iron as an Electrobiochemical Process in Anaerobic Soils, *Water*, vol. 18, pp. 147-165, 1934.

ACKNOWLEDGMENT

This article is based upon investigations supported by a grant-in-aid from Armour and Company, Chicago, Ill. The laboratory work, and especially the field work, have been done in close association with the technical personnel of Orchem Corporation, Austin, Texas. Laboratory assistance has been given by Dr. L. Leon Campbell, Jr., Mrs. Pauline Dvorak, Mrs. Nancy Albritton, and by Miss Nancy Nichols.

New Correlation

• CONTINUED FROM PAGE 166

flow (similar to shaft work in driving a turbine).

W_f = Energy losses due to irreversibilities of the fluid in flow such as slippage or liquid hangup, frictional effects due to the surface of the tubing, change in surface areas between the mixture of liquid and gas flowing in the tubing, combinations of any of these plus other effects not accounted for.

$\bar{v}$ = Arbitrarily defined as constant and equal to the integrated average velocity between the pressure limits of P_1 and P_2 where v is based on the ratio of fluids flowing into and out of the flow string.

D = Inside diameter of tubing in feet.

f = Dimensionless correlating function.

V_m = Cubic feet of mixed gas, oil and water at pressure P per barrel of stock tank oil, based on the ratio of the fluids flowing into and out of the flow string.

M = Total mass of gas, oil, and water in pounds, associated with one barrel of stock tank oil flowing into and out of the flow string.

Q = Barrels of stock tank oil produced per day.

$\bar{V}_m$ = Arbitrarily defined as constant and equal to the integrated average value of V_m between the pressure limits of P_1 and P_2.

F = Formation volume factor of the oil at pressure P. Barrels of reservoir oil per barrel of stock tank oil.

$S_{g/o}$ = Producing gas-oil ratio, cubic feet per barrel of stock tank oil.

S_s = Solubility of gas in oil at pressure P, cubic feet per barrel of oil.

V_w = Cubic feet of water produced per barrel of stock tank oil.

T_{avg} = Arithmetric average temperature in the tubing in degrees Rankine.

T_a = Base temperature.

P_a = Base pressure.

Z = Compressibility factor of gas.

n_f = Slope of formation volume factor curve.

F_i = Intercept of formation volume factor curve.

n_s = Slope of solubility curve.

S_i = Intercept of solubility curve.

G_{sto} = Specific gravity of stock tank oil.

G_g = Separator gas gravity (air = 1).

G_b = Specific gravity of produced water.

$\bar{\rho}$ = Integrated average density in pounds per cubic foot.

ρ = Density at pressure P in pounds per cubic foot.

P_c = Pseudo critical pressure of gas.

T_c = Pseudo critical temperature of gas.

T_r = Pseudo reduced temperature.

P_r = Pseudo reduced pressure.

ACKNOWLEDGMENT

This article was condensed by the authors who prepared the original paper "Multiphase Flow of Gas, Oil and Water Through Vertical Flow Strings" presented at the Mid-Continent Meeting of the API Division of Production, Wichita, Kan., March 19-21, 1952. The authors thank the Bureau of Mines at Bartlesville, and Alton B. Cook of the Bureau for providing essential data on flowing wells. Gratitude is expressed to A. F. Bertuzzi, R. G. Nisle, and to those in the Production Department of Phillips Petroleum Company who provided vital information.

When finally brought under control, the original completion of the Doornbos McPherson N-1 included a christmas tree located some 150 feet from well. Note that blowout preventers, rotary, short section of drill pipe, rotary bushing and kelly remain in place on drilling derrick and substructure.

Magnolia Makes an Unusual Completion in Wilcox

A near wild well is turned into a commercial producer by some unique methods.

By J. E. KASTROP, WORLD OIL Staff

RECOMPLETION IN APRIL of Magnolia Petroleum Company's Doornbos McPherson N-1 in the Hurricane Creek field of Beauregard Parish, marks the end of a "problem well" that resulted in one of the most unusual completions in Southern Louisiana. Originally drilled in the latter part of 1951, the well almost became a disastrous blowout in November of that year when testing the middle Wilcox formation at a depth of 14,573 feet.

Quick thinking and unorthodox hookups converted this near-wild well into a prolific oil well and the deepest Wilcox producer known. While the completion was far from anything desired or planned, such an arrangement as described later resulted in the safe production of oil and gas. Because of unusually high flowing pressures and the temporary means installed to control the well, it was allowed to produce only until such time as well conditions permitted the operator to safely rework the well and make a conventional completion. This recompletion was made recently.

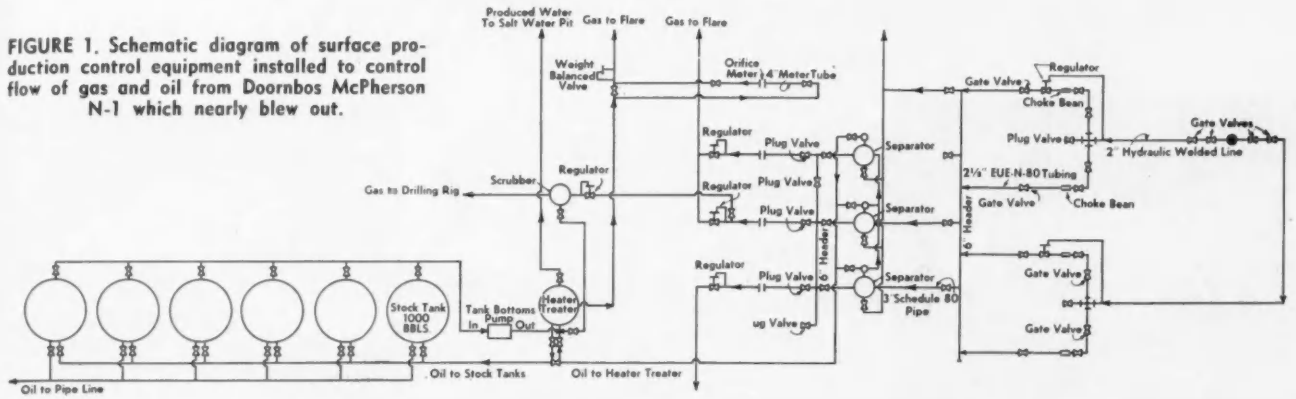
Magnolia was making a series of formation tests on the well when it began to kick and nearly became a serious blowout. When finally controlled so that production could safely be flowed into stock tanks, the Doornbos McPherson N-1 became probably the only well of its kind where the christmas tree was located some 150 feet from the well. A significant feature of this entire operation, outside of its unusual nature, is that out of this near disaster it was demonstrated what can be done in an extreme emergency by skilled personnel. While the payout on this well may yet be uncertain when considering the original cost and the expense of the recompletion, badly-needed oil was channeled into the pipe line to help meet heavy demands on the industry.

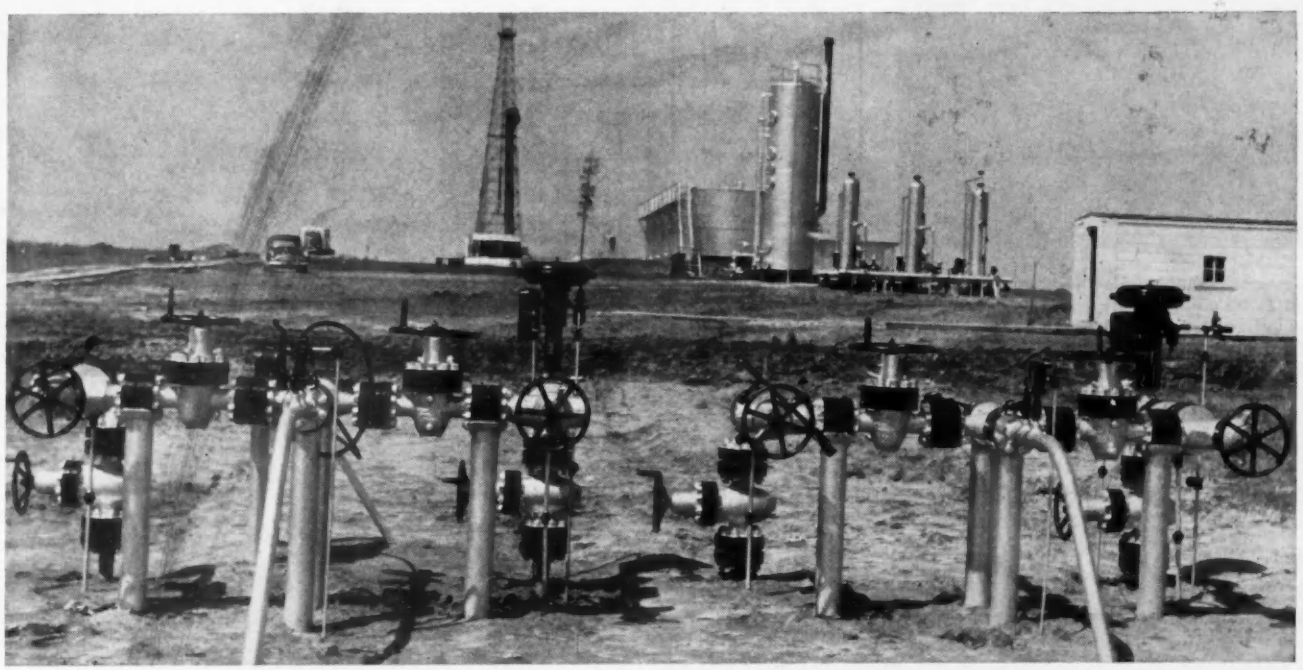
Middle Wilcox Test. Hurricane Creek was discovered in February, 1948, and produces from the Cockfield at an average depth of about 8300 feet. Geological information pointed to a deep test and a permit was obtained to drill to 13,500 feet. The sand was not penetrated at this depth, so the well was extended. A test at 13,620 feet in the upper Wilcox brought only a slight show of oil and gas so the well was drilled further. Seven-inch casing had been set to 13,579 feet and cemented with 1000 sacks of cement, and it was this extension of depth that brought about a difficult casing problem. The well was plagued with high pressure due to gas sands penetrated at 13,620 feet, and high temperatures, necessitating a heavy mud.

After drilling to a total depth of 14,573 feet, 1203 feet of 5-inch flush-joint liner was set to 14,530 feet, with the top of a liner at 13,327 feet and well inside the 7-inch casing. A series of production tests were made in the open hole below the liner. Due to plugging the pipe by dehydrated mud, the tests were not successful, and testing equipment pulled from the hole.

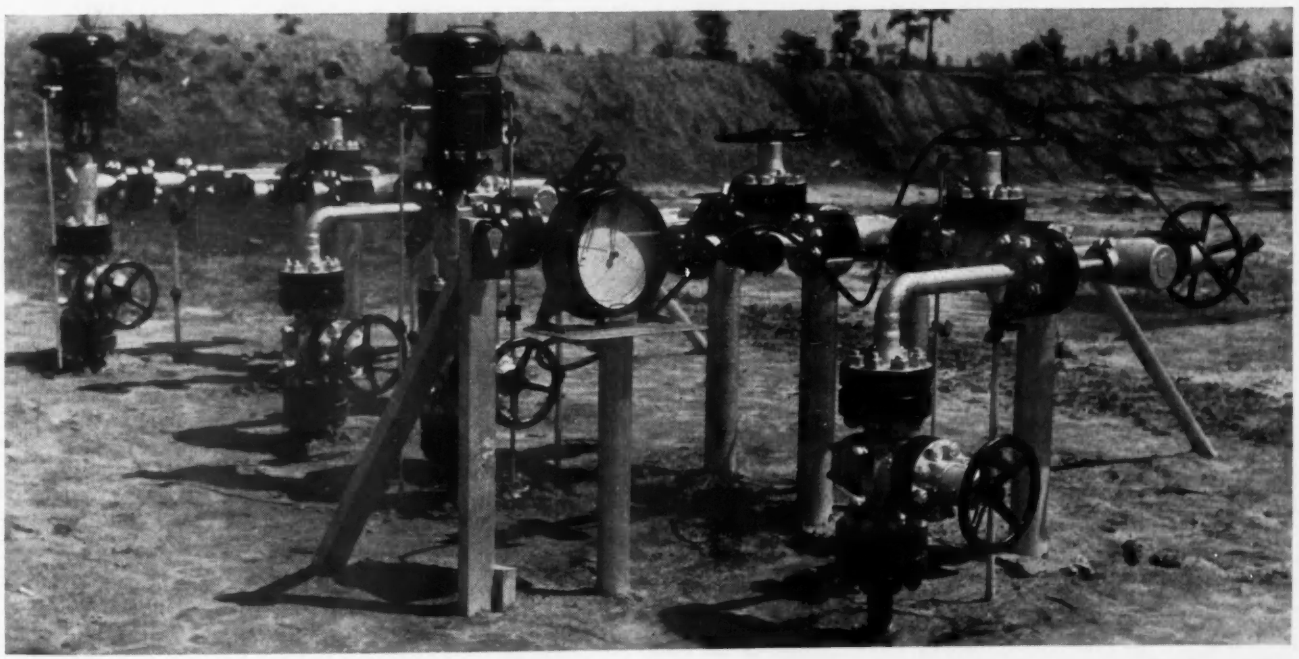
In order to condition mud all the way to bottom, 2-inch upset tubing

FIGURE 1. Schematic diagram of surface production control equipment installed to control flow of gas and oil from Doornbos McPherson N-1 which nearly blew out.

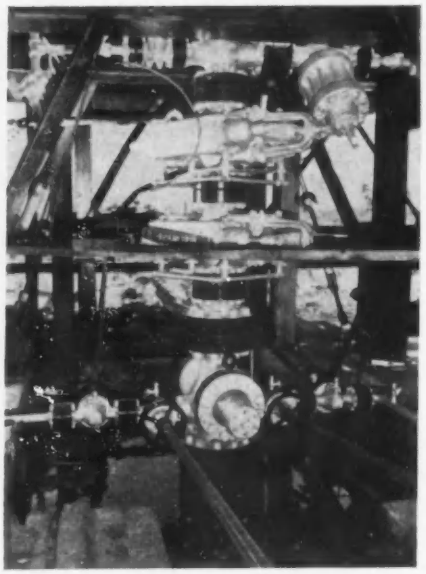




Dual hydraulic lines with full well pressure carried the fluid to dual choke systems which control the flow. Beyond the tank battery erected especially to handle the unusual conditions at the Doornbos McPherson N-1 is the offset and relief well, the P-1, which has since been completed.



Well-head pressure was recorded on 24-hour charts, as shown in this view of one of dual wings. The dual choke system on each wing made it possible to change chokes easily and safely during the high-flow period when pressures were relatively high.



View of the well head on the Doornbos McPherson N-1 showing location of equipment as the well attempted to blow out. This equipment was left in place during the initial flow period before the well was killed and recompleted as a gas lift producer. Two-inch hydraulic flow lines are shown on either side of head.

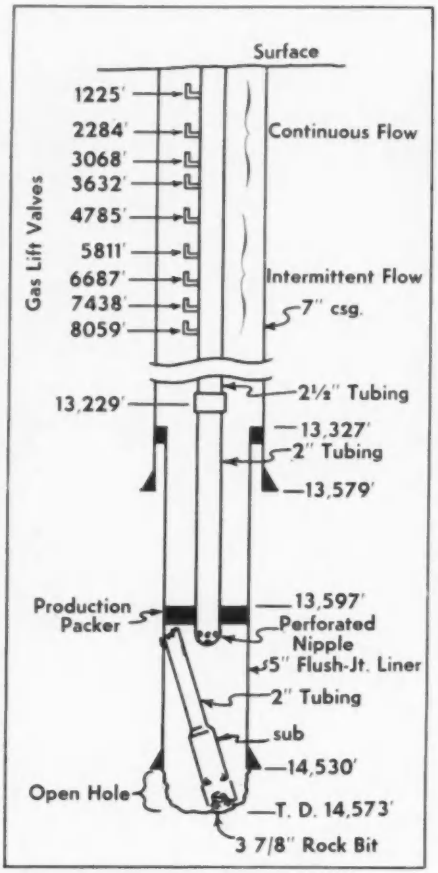
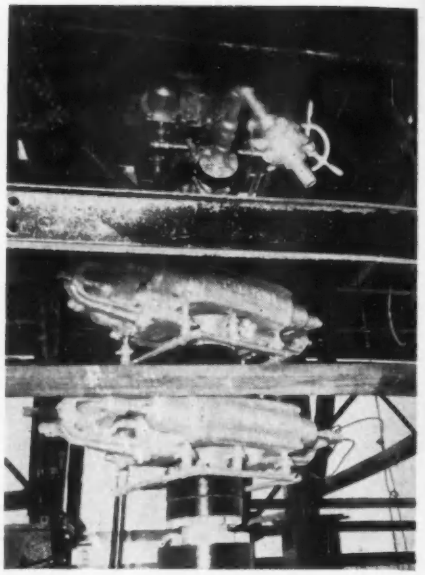
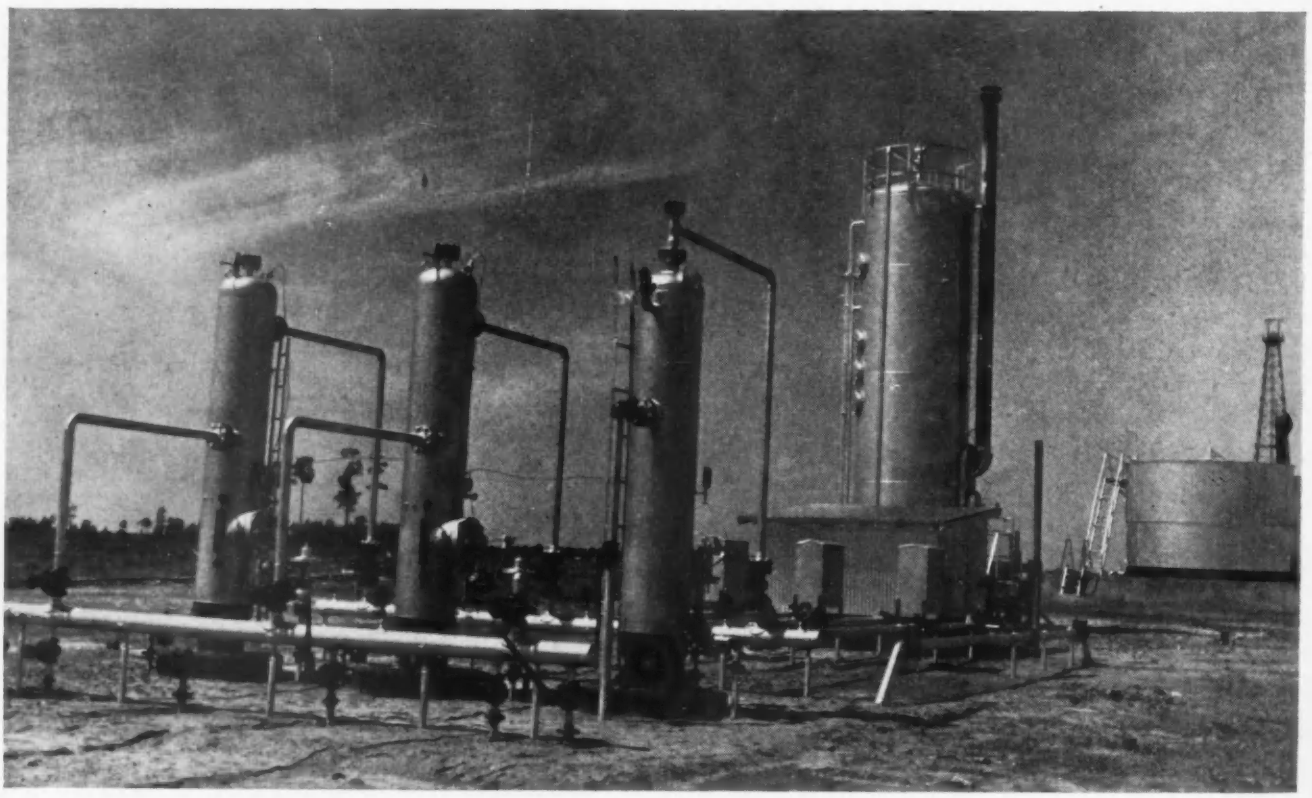


FIGURE 2. Recompletion program of Doornbos McPherson N-1.



All three of the 6-inch blowout preventers used during the drilling operation are shown here. An effective seal was made against the drill pipe under as much as 6300 pounds pressure so that the well could be produced through the wing lines. This equipment remained on the well until it was recompleted as a gas lift well.

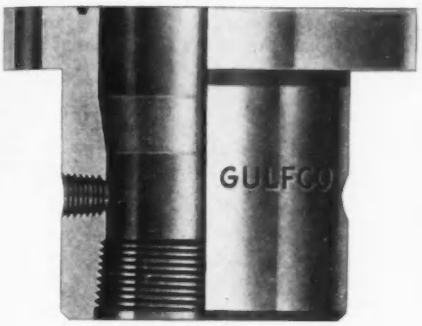


This tank battery was set up especially for the unusual conditions. Separators stand between the liquid header in the foreground and the gas header immediately beyond. This equipment has been replaced by a more conventional hookup for the recompleted well.

you gain by using our 34 years' experience

where experience counts—in the world's greatest oil fields . . . saves you time and money.

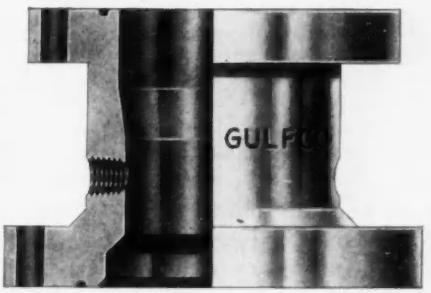
GULFCO FORGED STEEL CASING HEADS

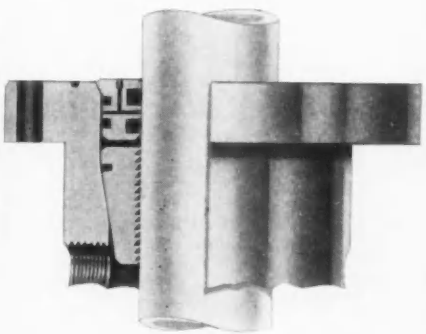


TYPE RS CASING HEAD BODY

TYPE RS-F CASING HEAD BODY

These Gulfco Forged Steel A.P.I. Full Opening Casing Head Bodies are designed for maximum practical flexibility. All hangers shown below are interchangeable in these bodies giving the operator a varied choice of casing suspension, and the option of changing the casing program without removing casing head body. Type RS Casing Head Body can be furnished with male threaded bottom connection if desired.



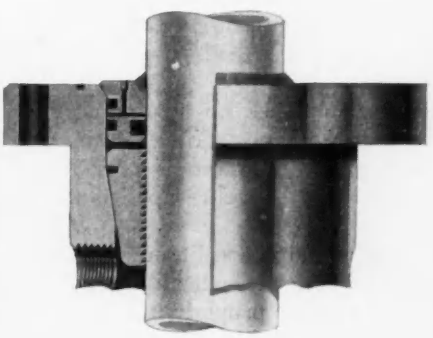


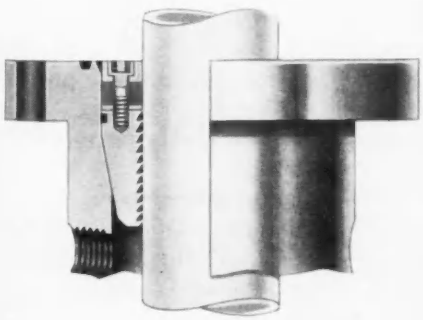
TYPE RS-4 SLIP-TEST SEAL SUSPENSION

This field tested seal owes its merit to simplicity in design, rugged construction and dependability in use. After the three-segment hinged slips are set with the proper tension on the casing, the pipe is cut at the desired length above the casing head flange. Then the seal is slipped over the pipe and the oversized synthetic rubber "O" rings effect a positive pressure seal in the annular space between the pipe and the I.D. of the casing head. The seal can be tested immediately without installing the next head or a test flange.

TYPE RS-3 SLIP-TEST WELD SUSPENSION

The slips used with this seal are identical to those furnished with the Type RS-4. The difference in the seals is that the Type RS-3 is provided with a bevel for welding around the pipe at the top. This type seal can be tested between the weld and the synthetic "O" rings without the use of a test flange and before the tubing head is installed.





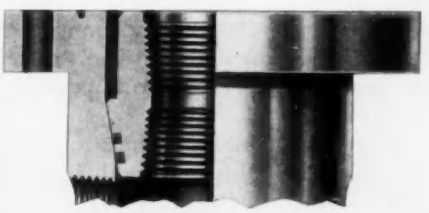
TYPE RS-1 SLIP-PACK SUSPENSION

This slip suspension hanger is made in three segments hinged together to assure perfect concentric alignment. After the cement has set, proper tension is taken on the casing and the slip-pack assembly is wrapped around the pipe and dropped to its seat.

The casing load is immediately taken by the slips, then the socket head cap screws may be tightened to compress the synthetic rubber packing and effect a positive seal.

RS-2 THREADED SUSPENSION

This "Boll-Weevil" Threaded Suspension hanger is simple, easy to install and has an unusually efficient hydraulic packing arrangement. When this type suspension is desired, the lower flange of the G-1F or G-2F tubing head is furnished with a ring of hydraulic packing which bears on the hanger and holds it firmly in position.



PRODUCTS MANUFACTURED BY GULFCO

Christmas Trees
Casing Heads
Tubing Heads
Casing Head and Tubing Head Adapters
Stripper Rubbers
Stripper Rubber Pullers
Christmas Tree Fittings
Quick Change Crosses and Tees
Casing Shoes
Slush Pump Liners
Low-Pressure Gas Burners
Low Water Alarms
Emergency Fuel Shut-Offs
Boiler Feed Water Regulators
Gas Firing Controls

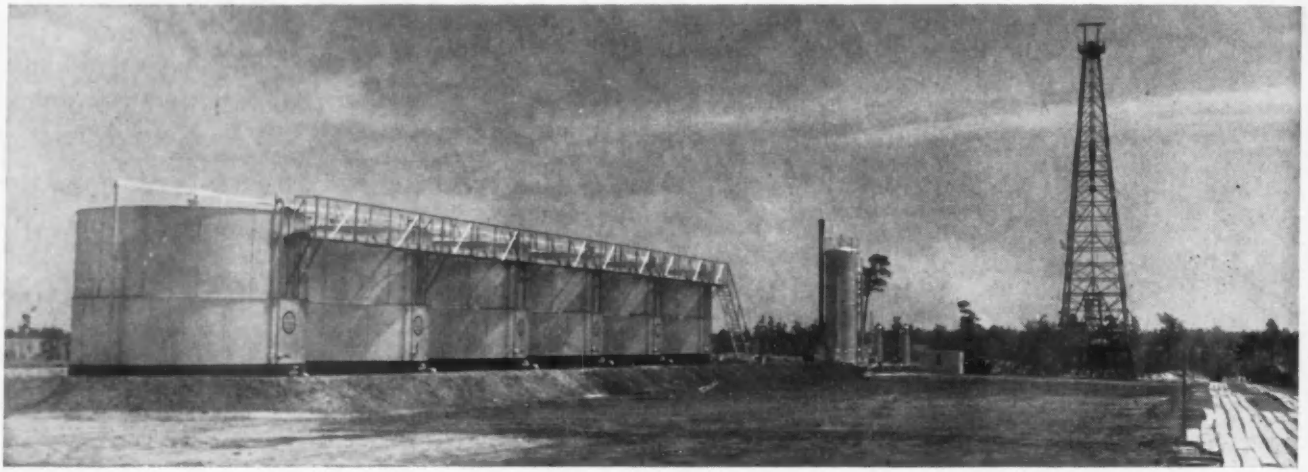
BE SAFE . . . BE SURE . . . CALL GULFC

GULF COAST MACHINE & SUPPLY COMPANY

GULFCO TRADE MARK PRODUCTS

GENERAL OFFICE AND SHOP: 305-315 Orange Street, P. O. Box 1150—Phone 2-8481
BEAUMONT, TEXAS

HOUSTON SALES OFFICE: Esperson Bldg., Houston 2, Texas—Phone FAirfax 1544
CORPUS CHRISTI SALES OFFICE: 3407 Agnes Street—Phone 2-5361
WICHITA FALLS SALES OFFICE: 100 Henrietta Street—Phone 2-9407
ODESSA SALES OFFICE: 900 East 2nd Street—Phone 2-2895
NEW YORK EXPORT OFFICE: R. S. Stokvis & Sons, Inc., 17 Battery Place, New York 4, N. Y.



This is what the Doornbos McPherson N-1 looked like during the time it was allowed to produce under an emergency setup. At first glance, this may appear as an active drilling rig, but it was necessary to leave some drilling equipment in place in order to complete the well safely. It has since been recompleted as a gas-lift well.

was run in the well on 3½-inch drill pipe. When the lower end of the pipe reached 8450 feet, the well began to kick, and the rams were closed with 1700 pounds pressure on the drill stem. Mud was circulated under 1500 pounds pressure on the pipe. Five hundred pounds back pressure was held on the casing by a ½-inch choke. Choke size controlling the mud return was changed to ¼-inch and 2600 to 3000 pounds pressure was required to pump into the drill pipe with 1600 to 1800 pounds on the casing. The formation failed to take any mud with 3600 pounds surface pressure, so the connections were reversed and 5000 pounds pressure applied to the casing.

The standpipe split under the return pressure and when the kelly cock failed to close properly, the kelly was broken out and a 3½-inch sub with two 15,000-pound test valves were added. Weight of the mud was brought up from 18.0 pounds to 20 pounds and circulated under 3000 pounds pressure with 3800 pounds on the casing. Returning mud was badly gas-cut and weighed only 14 to 17 pounds per gallon.

After unsuccessful attempts to load the hole with 20-pound mud, it was decided to run the pipe further in the well, conditioning the mud at intervals. Twenty additional stands and two doubles were run in to 10,310 feet and 20 pound mud pumped in. Gas-cut mud returned with a weight of 16 pounds, and preparations were made to run in more pipe under pressure when for yet some undetermined reason beyond the fault of personnel in charge, the drill stem was dropped into the well. The master valve stuck before closing and it was some quick acting and thinking that prevented a disastrous blowout. Before the well had time to commence blowing, three stands of 3½-inch drill pipe were run in the hole, the kelly connected and the well shut in by closing the rams on the three 6-inch blowout preventers used on this deep well. After the rams were closed, there was an upward surge of the drill pipe that bent both the kelly and the extended part of the pipes above the rotary. Movement was stopped when the upset on the joint of pipe engaged the lower preventer ram, and at this point, the rubber rams were frozen against the drill pipe. The kelly cock had been shut and flow was halted.

Pressure Grows. Pressure on the well continued to climb to 6225 pounds, which would be reduced by bleeding fluid through the casing choke and pumping in a few barrels of heavy mud. However, it would build back up again, and at one time reached a maximum of 6300 pounds. A leak developed between the casing head and the lower preventer, and pressure was again bled from the well and these bolts tightened. The well would flow mud, gas and oil when the choke was opened, and it was just a short time until the ¼-inch choke was enlarged by erosion of the mud to ¾-inch. Two ¼-inch chokes were installed on either wing of the tubing head, and when the well was allowed to bleed down, gas and oil were produced under a flowing pressure of 5000 pounds.

Producing Under Adverse Conditions. Two large open pits were hurriedly dug and the well was permitted to flow into one pit or the other through either of the ¼-inch choke lines. This emergency measure was necessary until flow lines and production equipment to handle the oil and gas under high pressures could be installed. The well stabilized on the ¼-inch chokes and flowed an estimated 1000 barrels per day of 36 to 40-degree gravity oil under 5000 to 5500 pounds well head pressure. The highest measured production was 1658 barrels daily through 12/64 and 16/64-inch chokes, and the pressure dropped to 4400 pounds with a gas-oil ratio of 2452. No appreciable water was produced initially during the first several days the well flowed.

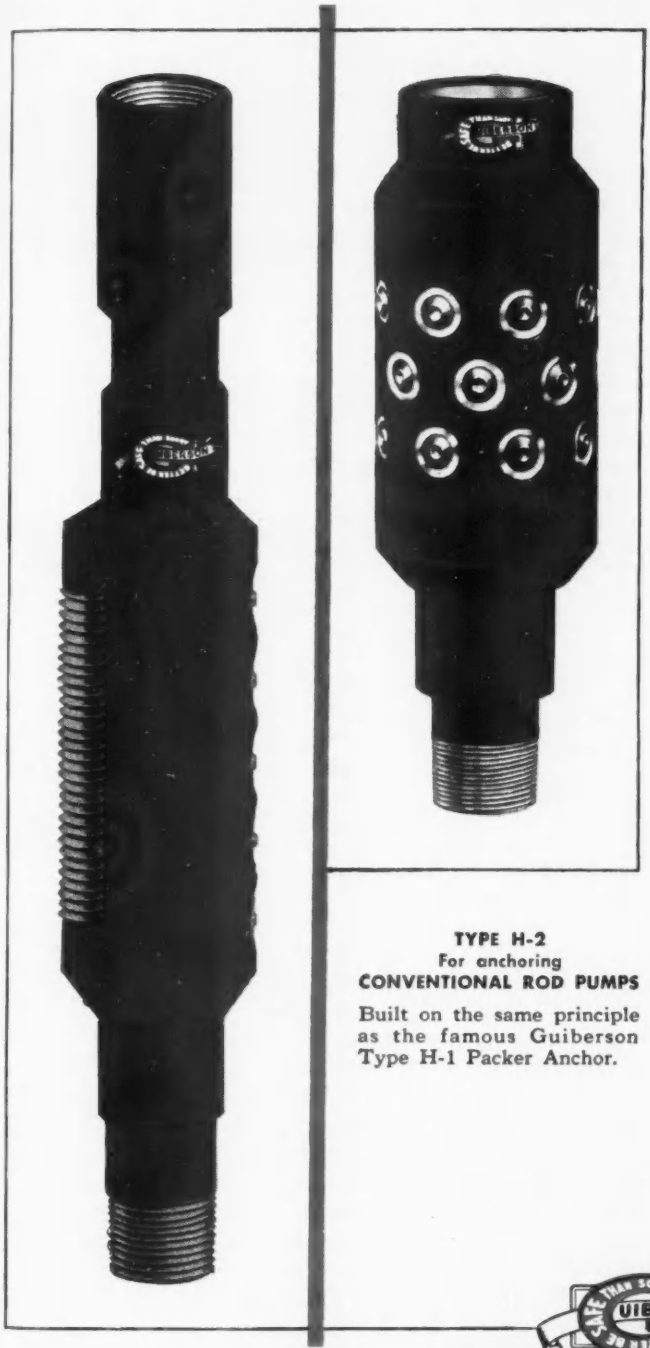
Statewide Hearing. A special hearing was held by the Louisiana Conservation Commission to determine the proper method of producing the Doornbos McPherson N-1. At this hearing, it was agreed by those present that under the circumstances, it was advisable to produce the well at a high rate to minimize surface pressure and reduce the hazard, and thereby eventually lower the formation pressure.

Six 1000-barrel storage tanks were installed, high and low-pressure separators erected, and dual flow lines laid from each wing of the casing head. Each flow line contained two chokes that could be alternated when it was necessary to change a choke in either flow line. Chokes had to be changed quite frequently during the initial producing stages due to cutting out the chokes by the fluid produced.

CUT PUMPING COSTS 3 WAYS

with GUIBERSON Hydraulic Pump Anchors

Cut first cost
Cut wear on string
Lift more fluid



TYPE H-2
For anchoring
CONVENTIONAL ROD PUMPS

Built on the same principle as the famous Guiberson Type H-1 Packer Anchor.

For parallel string "FREE PUMPS," for ROD PUMPS these new Guiberson anchors provide an ease of setting, a dependable grip on casing and a simplified release in two models. First cost is amazingly low. Operation is simple and sure — they save wear and tear on your string — let you lift more fluid through increased pump efficiency.

Anchor sets *automatically*, as soon as fluid level in tubing is higher than casing fluid level. No manipulation of tubing string is necessary. A series of *individual piston slips* operating hydraulically and independently of each other give positive grip on casing. Stabilizes tubing against all forces tending to cause movement. Holds equally well in any direction and may be run either-end-down. Anchor is easily released by normal methods of equalizing tubing and casing pressures or with bleed joints... either tension type (for single strings only) or pressure operated.

TYPE O. For anchoring parallel strings in "FREE PUMP" installations. Has tremendous by-pass area. Anchor grips casing with hydraulically-actuated piston slips and a fixed slip, which can be rotated to provide new gripping surface with each setting. Anchor is easily adjusted for different casing weights by changing fixed slip only. Very practical in conventional rod pump strings. Flat side by-pass permits running bombs in annulus.

A Guiberson Hydraulic Pump Anchor is a small investment for a big return in profitable operation. It will save you money — while it makes you money!

SAFE THAN SORRY GUIBERSON BETTER BE

THE
GUIBERSON
CORPORATION

ESTABLISHED 1919 • DALLAS, TEXAS, U. S. A.

Sold By Leading Oil Field Supply Stores Everywhere

Other Production Equipment. Flow valves and chokes were placed about 150 feet from the well as a safety measure, and the well produced as it existed at the time it attempted to blow out. There was approximately 43 feet of open hole below the liner, 10,310 feet of 2-inch tubing and 3½-inch pipe suspended below the three blow out preventers. The kelly with the cock closed, and the exposed joint of pipe are supported by the swivel, hook and traveling block, all of which were anchored in place by bolting down the drum end of the drilling line.

The rotary could not be removed, nor could the substructure, derrick or crown block. These items of drilling equipment had to remain in place, since they could not be removed without disturbing the pressure seal provided by the blowout preventers against the drill pipe. Any possible hazard by going back into the well was eliminated by leaving this equipment in place, and removing only those items of equipment that could be taken out without danger of causing a leak in the seal around the drill pipe.

The well was allowed to produce under this unusual arrangement until the bottomhole pressure declined to safe working levels.

Layout of production equipment is shown in the diagrammatic sketch, and photographs.

Production Control. Added to either side of the 15,000-pound test tubing head were two 2-inch 10,000-pound gate valves. Both 2-inch, hydraulic, all-welded flow lines carried the full well-head pressure to the unusual christmas tree control assembly, located about 150 feet from the well. Each line was connected to a system of dual chokes as shown in the diagram. The down-stream pressure below the normal operating choke was regulated to maintain an even flowing pressure on the separators, and thereby eliminated any possible pressure surges. A standby choke on the other wing of the tree was used to control the flow of oil only for a short time during which the other choke could be changed or adjustments made on the flow system. Both flow wings discharged into a 6-inch header which carried the fluid to the separators. Three separators installed remove small amounts of salt water and gas. Two of these units were high-pressure separators, with operating pressures of 500 pounds per square inch. The third unit was a low-pressure separator with an operating pressure of 100 pounds.

Each high-pressure separator was tied to the 6-inch header by 3-inch schedule 80 pipe. The water dump line discharged from the separators into a salt water pit, while the gas outlet was connected into a second 6-inch gas header. These two gas lines included meter runs in order to measure the gas produced. A third meter run was connected to the low-pressure separator to handle gas from this unit. A gas discharge line from this unit was tied into the 6-inch gas header, but blocked off from the higher pressure section by a plug valve. Back pressure was maintained on all three runs by means of regulators on the down-stream side of the orifice plates. One of the high-pressure meter runs discharged into one gas flare line, while the other discharged through a second flare line which also carried gas from the low-pressure meter run.

Relief Well. It was decided to drill a relief well on an offset location to the west to further lower the formation pressure in the Doornbos McPherson N-1, so the Doornbos McPherson P-1 was staked. This relief well was not intended to intercept the original hole, but was drilled straight down with the purpose in mind of tapping the same reservoir and producing the well at the allowable rate in order to further control the reservoir pressure in the N-1 well.

Fuel for the relief rig was supplied by the gas discharged from the middle or second high-pressure separator. A line tap was made just down-stream of the regulator on the meter run, and the line connected to a gas scrubber unit. Gas pressure on the scrubber was also regulated.

The Doornbos McPherson P-1 was spudded on Feb. 6, 1951 and drilled to a total depth of 14,656 feet. Casing program was as follows: 20-inch to 172 feet; 12⅜-inch to 2482 feet; 9⅝-inch to 9902 feet; 7-inch to 13,695 feet; and a 5-inch liner 169 feet long set on bottom. The well was perforated from 14,496-14,514 feet, and on initial tests made 105 barrels of oil, no water, through 8/64-inch choke with 1700 pounds tubing pressure. Gas-oil ratio was 3324/1. It was completed Dec. 13, 1951.

N-1 Well Recompleted. Production and bottom-hole pressure dropped so that the N-1 well could be safely reworked. Tools were moved in Feb. 10, 1953 and the well killed. The 3½-inch drill pipe and 2-inch tubing were fished from the hole down to 13,616 feet, leaving an estimated 957 feet of two-inch tubing in the hole with a 3⅞-inch rock bit and sub on bottom.

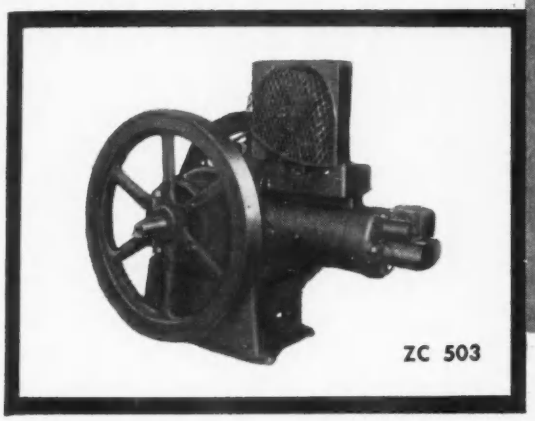
The Doornbos McPherson N-1 was then completed as a gas lift well according to the schematic diagram in Figure 2. A 5-inch production packer was run in the hole and set at 13,597 feet with a short perforated nipple extending below it. Three hundred and sixty-eight feet of 2-inch tubing was run on top of the packer with 2½-inch tubing extending from 13,229 feet to the surface. Nine gas lift valves were placed in the larger string, with the lowest valve located at 8059 feet. It was set to operate on a differential of 575 pounds pressure. The other valve settings and pressure differentials were as follows:

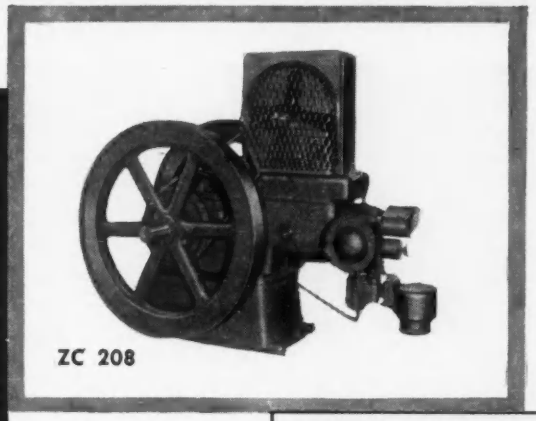
Valve Depth (feet)	Pressure Setting (psi)
1225	775
2284	750
3068	725
3632	700
4785	675
5811	650
6687	625
7438	600

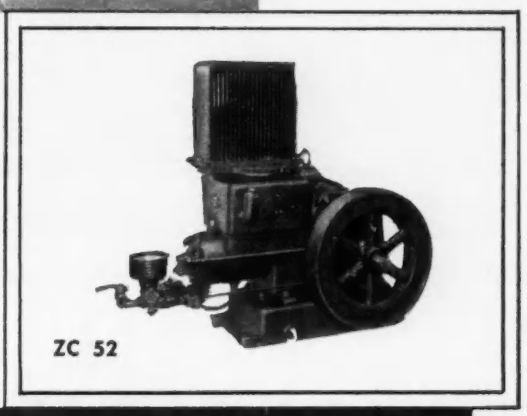
The upper four valves were of the constant flow type; the lower five valves were of the intermitting type. Gas was injected into the casing for 1½ minutes every hour. Gas was supplied to the well at 800 psi by a gasoline plant located nearby. Estimated daily injection rate is 72,000 standard cubic feet.

A potential test was made on April 9, 1953, and the well produced 22 barrels of 47.3 degree API gravity oil, and 4 barrels of water through a 1-inch choke with a gas-oil ratio of 1702/1. Tubing pressure ranged from 0 to 200 pounds.

Undoubtedly, the encroachment of water has blocked the flow of oil into the Doornbos McPherson N-1, and how long the well will continue to produce under the present arrangement is only an estimate. However, thousands of barrels of oil have been saved that otherwise might have been wasted in a complete blowout and subsequent plugged hole.





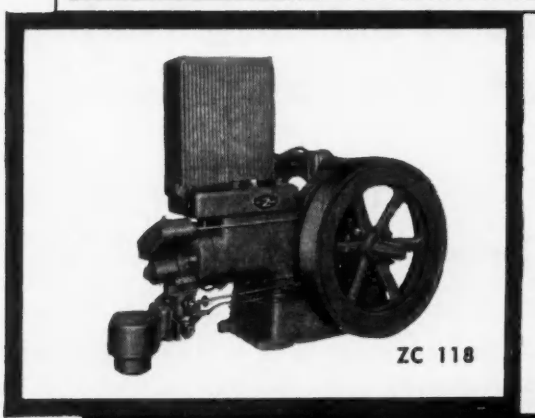


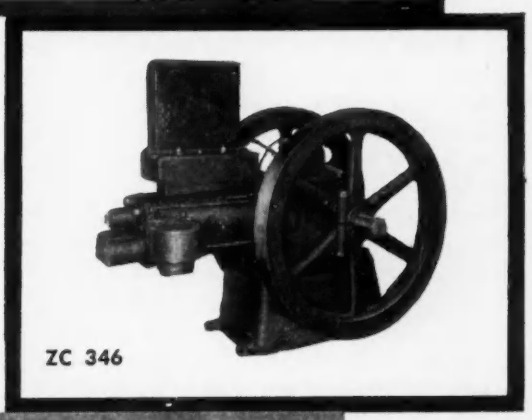
pick a "ZC" that best fits your pumping unit!

The broad Fairbanks-Morse "ZC" line has an engine that will best fit your pumping unit . . . from 3 to 30 hp. They're economical and easy to maintain—simply designed with no complicated parts or delicate adjustments.

All "ZC" sizes are high displacement, heavy-duty, slow-speed models—ideal for oil field pumping service! And, all sizes have the famous extra-heavy double flywheel for symmetry and perfect balance . . . with power take-off on either side of the engine.

See your local supply store about the "ZC" line . . . or write Fairbanks, Morse & Co., Chicago 5, Illinois.

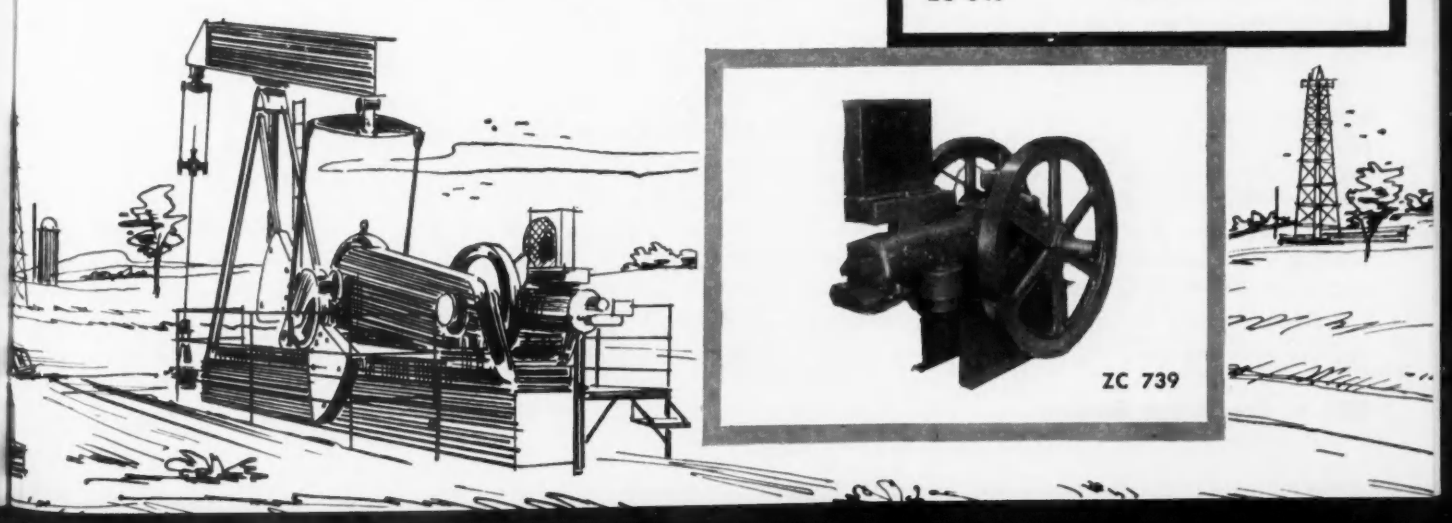


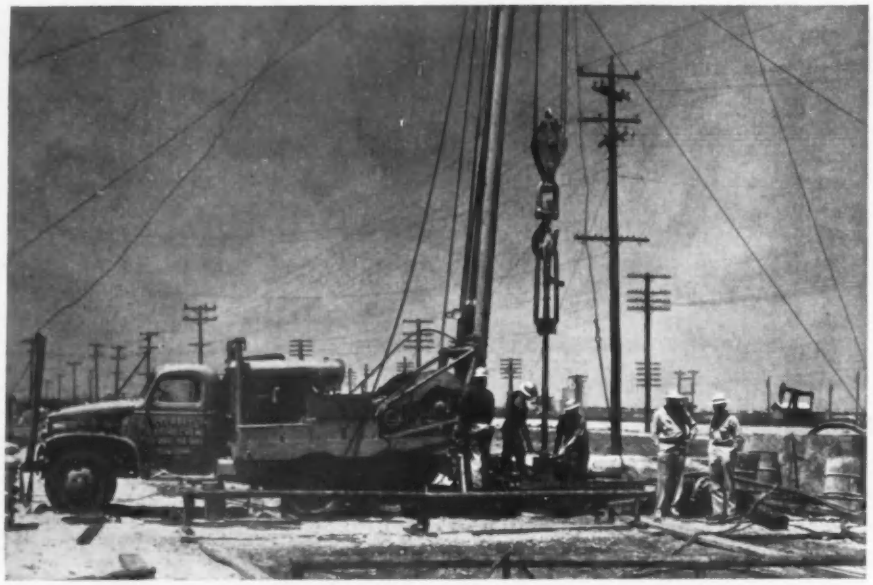


FAIRBANKS-MORSE

a name worth remembering when you want the best

OIL FIELD EQUIPMENT • PUMPS • SCALES • GENERATORS
ELECTRIC MOTORS • LIGHT PLANTS • DIESEL, DUAL FUEL &
GASOLINE ENGINES • MAGNETOS • DIESEL LOCOMOTIVES





Lightweight rigs such as this one can be used in many workovers when tubing serves as the drill string.

Use of Existing Tubing Cuts Workover Costs

It can save drill pipe wear, provide more pull at bottom of hole and simplify pressure control.

By E. O. STEWART and HENRY PRIESMEYER
Stewart's Casing Tools, Houston

LARGE CUTS IN workover expenses have been made by the proper use of tubing in working over old wells in the Gulf Coast Area. A wide variety of such jobs have been performed safely when tubing used was in good condition. External upset type tubing is now common in most oil fields, and there is a general trend toward its use in well repair work. Among these rework jobs are: well head squeezing, gravel packing, acidizing, milling, fishing, liner and screen pulling and formation fracturing.

In all of these operations, the use of tubing as a drill string offers many advantages. Loading, unloading, hauling, picking up and laying down drill pipe are eliminated. All of the wear and damage that goes with these operations are eliminated, not to mention wear caused by actual use.

Tubing permits the use of a light rig, and with any given rig, trip speeds are higher and wear on lines and hoist is less. Where rig size is the limiting factor, there is more pull left at the bottom of the hole. Equally important is the reduced danger to personnel.

Decisive Factors. Factors to consider before the decision is made to use tubing on workovers are:

- Age and condition of tubing
- Depth of well
- Previous well producing characteristics
- Type and extent of repairs to be made
- Type of equipment to be used with tubing.

Condition of the tubing is most important. If it is too far gone to use for workover operations, it is probably too poor to run back in the well for producing operations. It is usually wiser and cheaper to replace tubing (using the replacement tubing for the workover job), than it is to move in drill pipe for the workover job and rerun the old tubing. Corroded tubing and worn out threads are poor investments in any well. It is usually better to pull it for use in non-critical, surface installations.

Naturally, the type and make of tool to be run (with special attention to its operating peculiarities) have much to do with the decision to use tubing. If there is any doubt, consult the manufacturer about his experiences. If doubt remains, a service operator can often provide practical advice in the matter. Such advice is particularly useful where many factors are unknown and unexpected situations might arise. Regardless of the type of tool being used in the workover job, a safety joint run in the string just above the tool is a sound investment.

Auxiliary Equipment. Weight indicators, torque indicators, torque limit tongs and other safety devices are more necessary when tubing is used than when drill pipe is used. However, these devices pay for themselves in the time saved and damage eliminated. Air tongs, when used with a reliable pressure regulator, have proven worthwhile when employing tubing as the drill string. In addition to saving time, this combination eliminates the problem of under or over makeup on tubing threads. It also provides an ideal means of rotating the tubing. It gives a cushioned drive with a positive limit on torque, and it does not require the use of a kelly, which, in normal workover operations is relatively small and requires special handling to prevent bending.

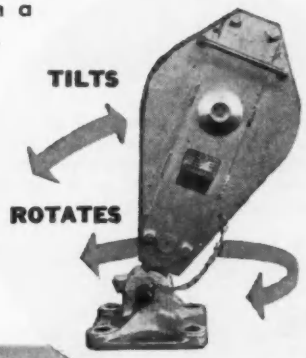
Pressure Control. In most workover jobs, the pressure encountered is low enough to eliminate the necessity of a bottom-hole packer. A seal around the tubing at the well head will suffice. The tubing is relieved of pressure loads so that most of its strength is available for other working loads.

There is no justification for making well repairs in an open hole. Since there is always the danger of unexpected pressure being encountered, or that small objects may be dropped in the hole, a stripper rubber should be used at all times. A big advantage in the use of tubing lies in the added safety which may be obtained from a

BIW DRILLING - PRODUCING WORKOVER EQUIPMENT

PEDESTAL SHEAVE BLOCK

BIW equipment is engineered with one idea in mind: to let you work over your wells in the most economical way. The BIW Pedestal Sheave Block is mounted on a base on the derrick floor and used in conjunction with tractor or hoisting winch for pulling rods or tubing or for swabbing. The block tilts 45 degrees each way from vertical and rotates about its vertical axis 22 degrees each way from a central position. In this way you get maximum pulling power from your winch with less wear on the wire line because there is no line rubbing on sheave edges or side plates.



TYPE NR-30 FLOOR BLOCK

The NR-30 can be installed anywhere: chained to the derrick foundation, anchored to a "dead man," or fastened down in any desired method where a concrete foundation has not been poured. This block is used with tractor or hoisting winch for swabbing and for pulling rods and tubing at medium depths. Write for the complete story on what these blocks can do to cut your drilling costs, increase your drilling efficiency. Beaumont Iron Works, one of the oldest oil country manufacturers, builds a complete line of drilling and producing equipment.

BIW

BEAUMONT IRON WORKS CO.
BEAUMONT, TEXAS

Subsidiary of American Locomotive Co.
General Sales Office: 1404 Dunlavy St.,
Houston 19, Texas
Warehouses in Beaumont and Odessa

simplified pressure control hookup at the surface.

With tubing, a ram-type master gate, a ram-type blowout preventer, and a stripper head are the basis of a safe, dependable pressure control system. Under most conditions, this simple hookup cannot be used with drill pipe because the stripper heads that will accommodate drill pipe, tool joints and casing protectors do not provide as safe operating conditions as when used with tubing. On deep wells, where drill pipe must be used, a hookup consisting of a ram-type preventer, a ram-type master gate, a cross, a ram-type preventer and an annular-type preventer are needed for complete safety.

Obviously, a pressure control hookup has to fit the job. For example, in the case of a well which has been on the pump for 15 years, the stripper is simply flanged directly to the tubing head. If desired, the tubing spider can be set directly on top of the stripper. On this job, other control equipment would not be necessary.

Where possible, a pressure test on the control assembly is desirable as soon as it has been mounted on the well. It is also good practice to operate the rams on control equipment at least once each day to insure good working conditions when the preventer is badly needed. Rams should not be used for working seals, and should be kept in the best possible condition for emergency use. When trouble is encountered, it is always best to work out the problem when using new ram rubbers rather than worn ones. Therefore, a stripper head is used instead of a preventer when only a working seal is required.

In addition to the safety features of using stripper-type seals, they are economical to use. No time is lost working collars in and out of the hole under pressure. The rate of wear on stripper rubbers is considerably less than the wear on ram rubbers, and the cost for stripper rubbers is substantially less.

On a recent Gulf Coast workover, a mixed string of tubing were stripped in and out of the hole under pressure 14 times while washing over tubing sanded in the well. While on bottom and washing, reverse circulation was maintained with pressures up to 800 pounds per square inch on the stripper. Each time a joint of the fish was pulled, it was stripped out successfully with the overshot. At the end of this particular job, the stripper rubber was in such condition that it could be used on subsequent jobs with lower pressure or larger diameter tubing. The pipe rams had only touched the pipe when the preventers were tested.

Tubing stripper bolted to casinghead serves as working seal when reworking even the lowest-pressure wells. Tubing spider and slips may be placed directly on top of it, or a blowout preventer can be hooked up.

Retainer ring is being tightened to hold down rubber element of tubing stripper.

Over-all Height. Another outstanding advantage in this type of hookup when using tubing for workovers is the low over-all height. Ram-type master gate and blowout preventers are each about 30 inches high, and the stripper head adds only about three more inches. A tee or cross is not ordinarily needed since the side outlet of the gate or of the tubing head is adequate for the limited amount of circulation involved in most operations.

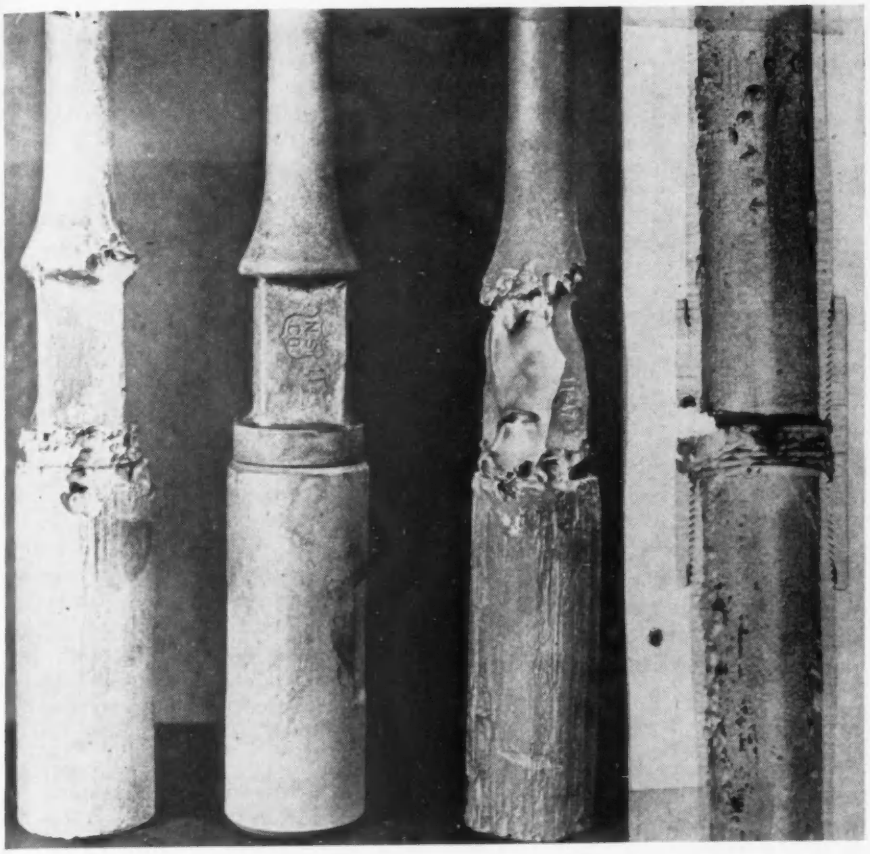
This type hookup is ideal for cleaning out, plug drilling, and washing over operations in that its use with tubing rotated by air tongs provides a simple, safe and economical reverse circulation system. Rotating packer heads, kelly and rotary table are not required in this type arrangement. Several jobs have been made successful through reverse circulation when at first they appeared as certain failures.

Safety Standards. All contractors naturally are going to modify their particular hookups to meet the requirements and regulations of the operator for whom they are doing any repair work. In general, standards of safety of the various operators usually have been higher than those of the contractors. Experience has indicated that no company was opposed to any equipment or practice which reduced the hazard and the expense of the workover operation.

Manually-operated and pressure-operated blowout preventers both have their places in workovers. Considerations of safety and economy determine which should be used for any given job. When any doubt exists as to which should be used for any particular job, it is well to remember that serious trouble is rarely encountered by having the rams close too fast. Pressure-operated preventers are not used which cannot be closed by hand in an emergency, except as auxiliary equipment.

Double units having both blind rams and pipe rams within a single body have been used. These units offer a considerable saving in height and eliminate one flanged joint. Such units provide more working room below the rig floor and each flange joint that is eliminated reduces another weak point in the hookup.

The general experience in the Gulf Coast during the last 15 years has indicated that in most cases faster, safer workovers are made more economically by using tubing than would be possible with drill pipe. In view of this experience, it is worthwhile to determine the condition under which the use of tubing is advantageous from the standpoint of safety and economy in well repair work.



The three ¾-inch sucker rods at left show galvanic corrosion. Center rod is new and is shown for comparison. Far right is an example of galvanic corrosion at collar of upset tubing. Corrosion was aggravated by fluid turbulence caused by the joint.

Some answers to . . .

Oil Field Scale and Corrosion

Here's how to combat an enemy that takes millions of dollars annually from producers.

By E. N. FRISIUS
Magna Products, Inc., Santa Fe Springs, Calif.

FOOTAGE OF TUBING replaced in 21 representative wells in one field in the Los Angeles Basin was reduced 92 percent during the first year of proper corrosion inhibitor treatment. During this same period, 89 percent of the amount of rods replaced was cut and breakdowns on this same number of wells in the same time were reduced 73 percent.

These are some of the results gained by adequate corrosion mitigation. Equally significant gains result from proper scale control. Scales formed in the production of oil and water may cause:

- Restriction of fluid flow into well.
- Wear and stick pump plungers and valves.
- Restriction of flow through tubing and gathering lines.
- Inefficiencies in heat exchangers.
- Plug waste water pumps and lines.
- Wash tanks to become inefficient.
- Plug injection apparatus and injection wells.

Corrosion, another arch-enemy of the producer, may

- Attack liners, enlarge perforations, to permit sand entry.
- Destroy pump fit, cutting efficiency and production rate.
- Destroy pumps themselves long before ordinary wear would require replacement.
- Destroy tubing, causing holes, splits, "worm tracks" and thread failures.
- Destroy rods, frequently by the mechanism of corrosion and fatigue.
- Destroy rod boxes and accelerate box "wear."
- Cause pitting of polished rods.
- Cause failure of flow lines, traps, tanks and other surface facilities.
- Complicate water injection problems by causing iron to be present in the injection water.

Scale and corrosion, therefore, must be fought all the way from the producing formation to the injection formation.

Scaling— occurs primarily because the water becomes unbalanced due to changes in temperature, pressure concentration of dissolved carbon dioxide, etc.

As fluid rises through the tubing of an oil well it encounters less and less pressure. The reduction in pressure reduces the ability of the fluid to hold carbon dioxide in solution. Bubbles of carbon dioxide break from solution and loss of carbon dioxide

Section of well liner showing typical corrosion and loss of metal where grain structure of metal was altered by torch-cut slots.

causes soluble bicarbonates to be converted to relatively insoluble carbonates. An excess of carbonates causes scale formation.

As a stream of well fluid saturated with carbon dioxide flows into a heated wash tank, the fluid is heated and much of the carbon dioxide breaks from solution. Loss of carbon dioxide causes water soluble bicarbonates to be converted to relatively insoluble carbonates. An excess of carbonates causes scale formation. Surfaces of the heating coils are normally the areas of most rapid scaling.

As a stream of waste water leaves a wash tank, it may be as warm as 180° F. As the water is pumped through a disposal line, it cools and the cooling results in lower solubility of dissolved solids. Supersaturation and scaling occur in the line.

Corrosion— occurs primarily because acid brine is produced along with the oil. The two most common corrodents in oil wells are carbon dioxide and hydrogen sulfide. After fluids reach the surface, a third corrodent, oxygen, often is introduced into the system. The basic mechanism of corrosion in an oxygen-free environment is an elementary galvanic cell formed by the electrolyte, an anode, a cathode and the metal path from the anode to the cathode. The anode and the cathode may be two points of unequal potential spaced a small fraction of an inch apart on the surface of say a sucker rod. The electrolyte is the acid brine.

While an atom of iron at the anode goes into solution as the acid brine, two hydrogen ions simultaneously give up their charges at the face of the cathode. There are many factors which affect the activity of this elementary galvanic cell such as polarization effects, acidity of the brine, water-to-oil, fluid velocity scrubbing action of gases, etc., but the cell is always rigidly governed by Ohm's classical law.

Scale Problem Treatments. Recent progress in the development of scale inhibitors has paid off handsomely in reduced operating costs and increased production. The following case histories demonstrate the economic practicability of scale control through use of modern scale inhibitors. These examples have been chosen because they are typical and because they show that the three most common types of oil field scale problems can be solved by inexpensive and simple methods.

SUBSURFACE EXAMPLE. Twenty-seven oil wells in four California fields have been treated with a modern scale inhibitor for from 6 to 15 months each. The average chemical cost has been 30 cents per well per day. Prior to treatment, these wells averaged 1.4 wet pulling jobs per well per year and six pump changes per well per year.

Since treatment has been initiated, there have been no wet pulling jobs, no evidence of scale formation and only 2.3 pump changes per well per year. In each of these cases the inhibitor is introduced into the casing annulus by means of a walking beam-operated pump. Since many of the wells require only one quart of the concentrated inhibitor per day, the inhibitor is diluted to provide sufficient volume to feed the injection pump continuously. This usually requires 15 to 20 gallons of water per day.

WASH TANK EXAMPLE. A wash tank in the Brea (California) field had to be shut down for a 2- or 3-day cleaning period every month. Chipping guns were used to remove hard scale from the heating coils and from the tank's interior. The scaling problem of course, carried on through the entire waste water system. Scale inhibitor was introduced directly into the water layer in the wash tank at a cost of 1.8 mills per barrel of water treated. At the end of the first month the tank was opened for inspection and found to have about 1/32 inch of loosely adhering scale, forming blotches on the otherwise clean coils. The dosage was increased 10 percent and since then no further scaling has occurred in over a year's operation. Of course, inhibitor carries through with the water and protects the remainder of the waste water system also.

WASTE WATER LINE EXAMPLE. A 10,000-foot waste water line had been used as a guinea pig for experiments with descaling and scale prevention methods. The suction portion of the line required cleaning on a six-weeks schedule; pump maintenance was excessive. A typical portion of this line consisted of eight-inch pipe which had become scaled until only three inches of effective diameter remained. A number of the older formulae had been tried, including at least two of the polyphosphates, and the best result obtained was a 50 percent reduction in the rate of scaling. Scale deposits were analyzed and found to

About the Author

E. N. FRISIUS received his B.S. degree in engineering from California Institute of Technology in 1938. He first worked for two years in geophysical exploration, then five years in engineering research. He spent seven years with Standard Oil Company of California where he pioneered in the application of special scale and corrosion inhibitors. He is now vice president of Magna Products, Inc.

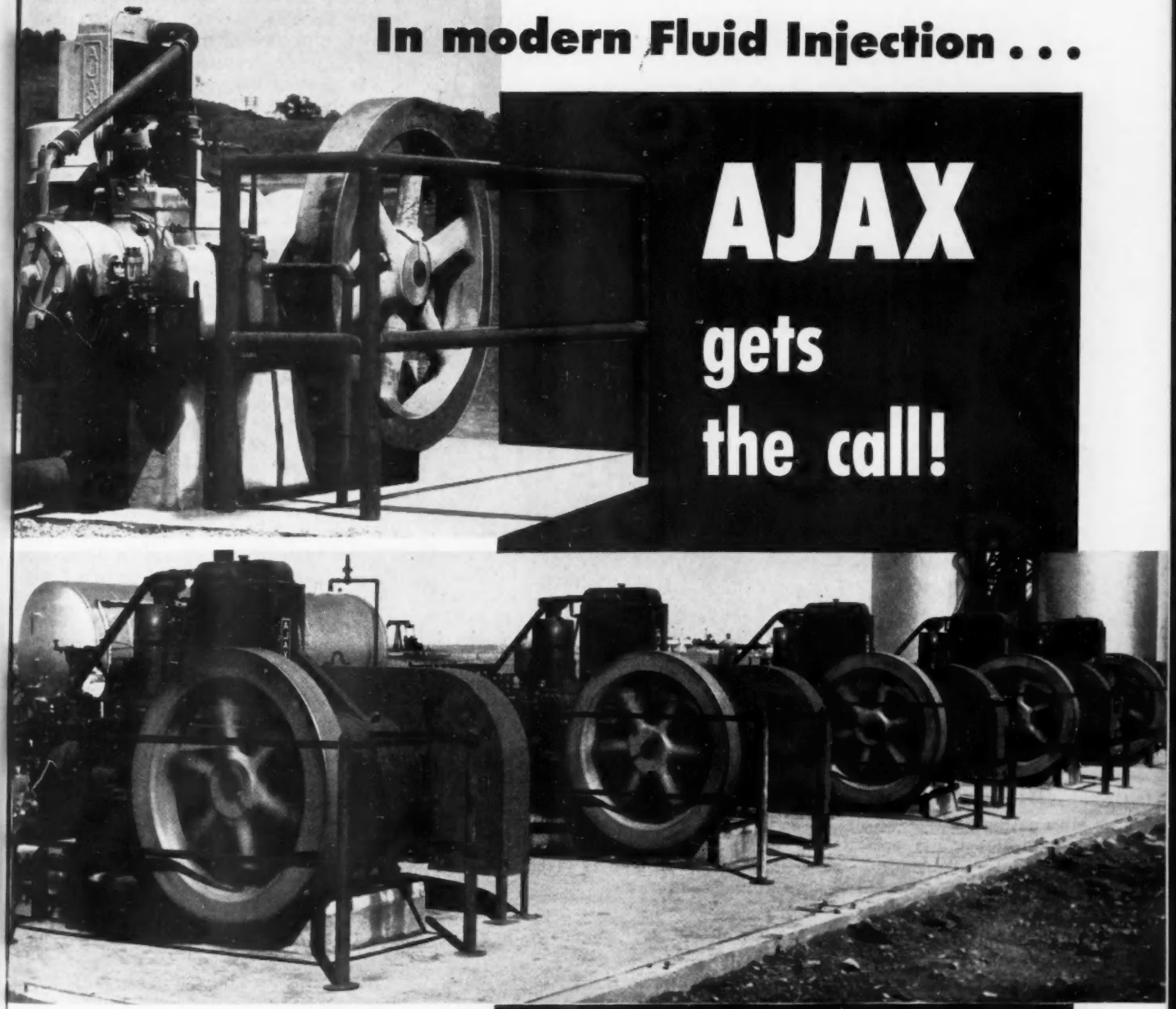
TABLE 1

Comparative records for year before and during treatment with corrosion inhibitor. Records are of group of wells in Los Angeles Basin.

	NUMBER OF BREAKDOWNS		TUBING REPLACED		RODS REPLACED		BOXES REPLACED		PUMPS REPLACED	
WELL	Before	During	Before	During	Before	During	Before	During	Before	During
A	18	1	148	0	38	0	36	1	11	1
B	19	3	87	1	51	0	67	12	13	3
C	25	14	64	1	188	14	131	6	5	2
D	24	2	77	14	175	42	32	10	7	3
E	20	1	87	0	79	0	39	0	8	1
F	22	8	93	0	110	5	314	39	10	8
G	33	10	47	0	137	35	98	164	12	7
H	31	6	106	1	119	8	85	10	6	4
I	18	10	122	27	90	0	25	24	9	5
J	21	8	73	27	90	2	130	0	11	5
K	13	2	63	14	29	0	52	16	5	2
L	11	1	46	0	9	8	8	6	7	1
M	17	5	62	0	5	1	87	10	5	4
N	30	6	32	1	79	0	75	13	9	5
O	9	4	42	1	20	2	10	5	6	2
P	7	3	38	17	3	1	27	0	5	1
Q	15	2	13	0	52	0	45	15	6	2
R	15	4	53	2	37	2	63	5	7	4
S	18	6	29	2	17	4	184	56	9	3
T	30	10	77	0	32	16	30	12	7	4
Total	396	106	1359	108	1360	140	1538	404	158	67
Reduction		73%		92%		89%		74%		58%

In modern Fluid Injection . . .

AJAX gets the call!



In the vital, expanding field of secondary recovery and pressure maintenance by fluid injection, Ajax Engines lead. The powerful DP-70 Model 11 x 14 shown above is the popular choice for economical, always dependable performance. Ask your Supply Man to detail the very good reasons-why!

AJAX ENGINES

AJAX Gas and Oil Engines

PESA — Petroleum Equipment Suppliers Association — Partners in Petroleum Progress

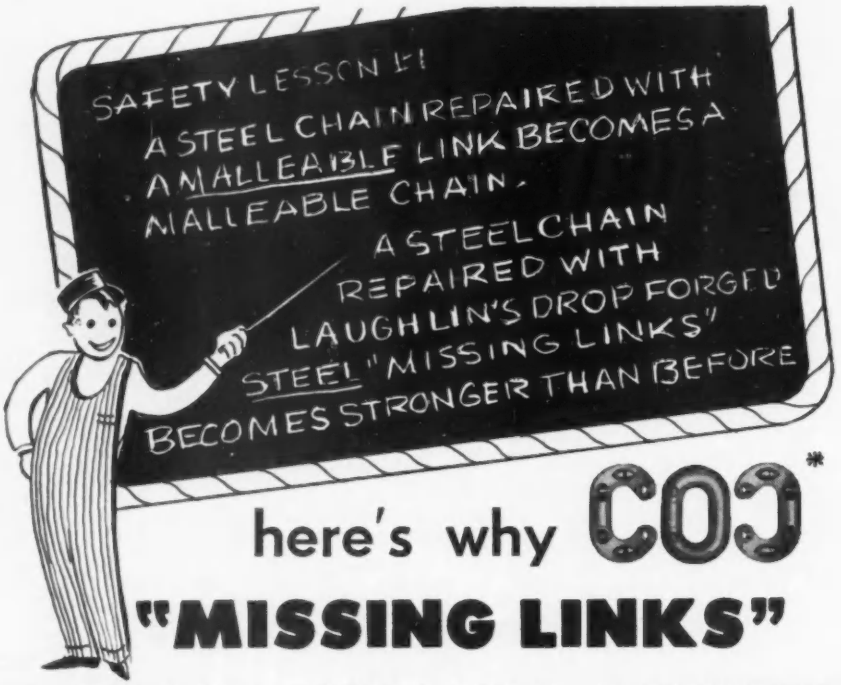
AJAX IRON WORKS

Builders of Gas Engines • Steam Drilling Engines • Industrial Steam Engines

CORRY, PENNSYLVANIA

Oil Field Distributors: THE NATIONAL SUPPLY CO., PITTSBURGH, PA.

R. B. MOORE SUPPLY CO., BOLIVAR, N.Y. • BETHLEHEM SUPPLY CO., TULSA, OKLA.


SAFETY LESSON #1
A STEEL CHAIN REPAIRED WITH A MALLEABLE LINK BECOMES A MALLEABLE CHAIN.
A STEEL CHAIN REPAIRED WITH LAUGHLIN'S DROP FORGED STEEL "MISSING LINKS" BECOMES STRONGER THAN BEFORE

here's why COJ*

"MISSING LINKS"

REPAIR CHAINS BETTER

"MISSING LINKS"

MATCHED

Made with special dies so that each half is pressure fitted. This eliminates play between the forgings, insures perfect fit when riveted into chain. There is no strain on the rivets.

INTERLOCKING LUGS

More costly to put in the dies, but they grip firmer and really do the work of taking the load.

ORDINARY LINKS

UNMATCHED

When loose fitting links are put into a chain and the load is applied, the rivets take most of the strain and tend to shear until the links set. This may later cause the link to open up under heavy load.

ROUND LUGS

Ordinary round lugs fitting into round holes don't have the holding power, tend to shear or force out under strain.

Laughlin "Missing Links" are made of carefully heat treated, high grade steel. They have features found in no other repair links, and are also supplied in an exclusive pear shaped design in sizes for 3/8" to 1 1/8" chain.

Buy From Your Local Distributor

He is in business to give you prompt, courteous service and to save you money, time and trouble. He's your one best source for industrial supplies.

FOR SAFETY'S SAKE SAY **LAUGHLIN**

THE THOMAS LAUGHLIN CO.
613 Fore St., Portland, Me.

*T. M. Reg.

contain appreciable quantities of barium and strontium as well as calcium and magnesium. The next step was to formulate a special inhibitor for the particular condition. Preparatory to using the new inhibitor, the suction portion of the line, which had necessitated cleaning every six weeks, was cleaned thoroughly by acidizing. Careful hydraulic measurements were made at intervals along the rest of the line.

A program of continuous injection of inhibitor was then started. At the end of 6½ months of treatment, the suction line was still shiny and clean, there was no scale in the pump and hydraulic measurements showed no new scale deposition anywhere along the line.

Treatment of Corrosion. The essential element in a successful corrosion control program is continuous of attention. Study must be given each individual well before treatment is begun. And a continuing study must be made of treating results and of changes in each well's characteristics. Well records shown in Table 1 have been compiled for wells in a Los Angeles Basin field and cover a year prior to and a year during the use of a corrosion inhibitor. Reduction in well maintenance shown in the table is typical of results for wells in which breakdowns before treatment were caused mainly by corrosion. There is often an interim period of a few months after corrosion inhibitors are started before the optimum reduction rate is obtained. This may result if well equipment has been corroded severely before treatment was begun.

It is common experience to find that when a sufficient percentage of the wells in an area are treated with a good corrosion inhibitor, the flow lines, tanks and other surface facilities receive adequate corrosion protection from the inhibitor residuals which are present in the production of the wells. In one field with more than 180 wells, flow line leaks were so common that one crew was carried for the primary purpose of repairing flow line leaks. Now, 64 wells are receiving a good corrosion inhibitor and a flow line leak is rare.

Reduction in production costs and increase in production rates through the use of chemical inhibitors is receiving increasing recognition. Successful use of inhibitors is expanding at an accelerating rate. And within a few years their use may be as widespread as the petroleum production industry itself.

How to do it! PRODUCTION HINTS

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas.

Folding Rack Provides Maximum Side Clearance

Here's a pipe-carrying rack that can be removed easily, rotated through 180 degrees and reinstalled so maximum side clearance can be obtained when the unit is not needed. Principal parts of the rack, of all welded construction, are of 2 and 2½-inch pipe materials. Two of the four upright posts serve as the sockets into which two matching pins of the movable portion are inserted. The rack is in its inboard position. When needed to support a load of long tubing or sucker rods, the unit is lifted up, rotated through 180 degrees and reinserted in the sockets. Each of the legs of the movable section may be secured by tightening down a bolt which is turned through a large nut welded over a hole burned into the front of the socket. An extension arm to provide additional leverage in cinching down these legs is welded at right angles to the bolt axis. The whole assembly is mounted on a flat plate which extends the full length, and on top of the front bumper.

Although the rack is adjusted easily to suit the needs at a particular time, it still retains the ruggedness necessary to carry a heavy load, the two-point support providing ample rigidity.

Traps Placed in Gathering Lines Aid Cleaning

Photo Courtesy East Texas Salt Water Disposal Co.

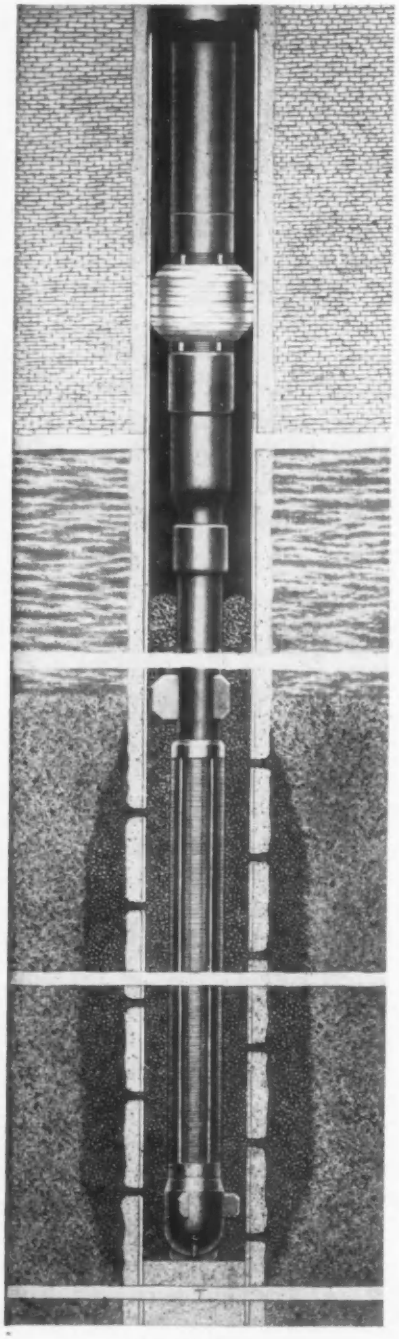
Special traps placed in a salt water gathering line of asbestos-cement pipe make it possible to periodically clean out the muck and scale that may accumulate in the line. These traps stop and block off pipe cleaning devices known as "pigs." Two lateral salt water lines are shown that merge into a trunk line. Each lateral line is equipped with one of these clean-out traps.

Installation of two such traps permits cleaning one line without disrupting the service of the other. The clean-out trap consists of two gate valves placed in each lateral line just upstream of the junction point. A pipe spool is flanged into the line between the valves so it can be removed to recover the clean-out pig.

During cleaning operations, the downstream gate valve is closed just enough to stop the pig when it reaches the valve. Muck and scale are pushed ahead of the pig so that this material is carried with the flow of the other lateral line. Once the pig is stopped by the downstream valve, both valves are closed and the flanges on the spool unbolted. The spool is removed with the pig which is recovered, and the spool reinserted. Once back in place, the spool of asbestos-cement pipe is ready to handle the flow of salt water and it is necessary only to open both valves to place the line on flow again. The ditch is left open so lines may be cleaned with little trouble.

when Sand IS YOUR PROBLEM . . .

. . . USE THE LAYNE GRAVEL PACK



Gravel Pack
Thru Perforated Casing

More and more Producers are finding "Gravel Pack" the answer to their most difficult sand problems—when it is done *RIGHT*.

The Layne & Bowler Company has the "KNOW HOW" at every depth.

Because the Gravel Pack can neither deteriorate nor enter the screen and because it permanently supports the formation and filters the flow, you are not confronted with the frequent expense of pulling tubing to replace sanded up screen and sand cut parts and other expenses involved in reworking wells.

Gravel Packing controls the productive sands. It surrounds the strainer with a natural filter, coarse enough for the oil to flow through, yet fine enough to retain the oil sand in its natural state of formation. Acting as a baffle, the gravel distributes the flow through the countless channels, lowering the velocity and preventing disruption of the fine grains of sand resulting in longer life for the well and equipment.

For longer, more constant flow of clean oil—let Layne & Bowler Gravel Pack your well.

•

The

LAYNE & BOWLER COMPANY

7800 Market St.
HOUSTON, TEXAS

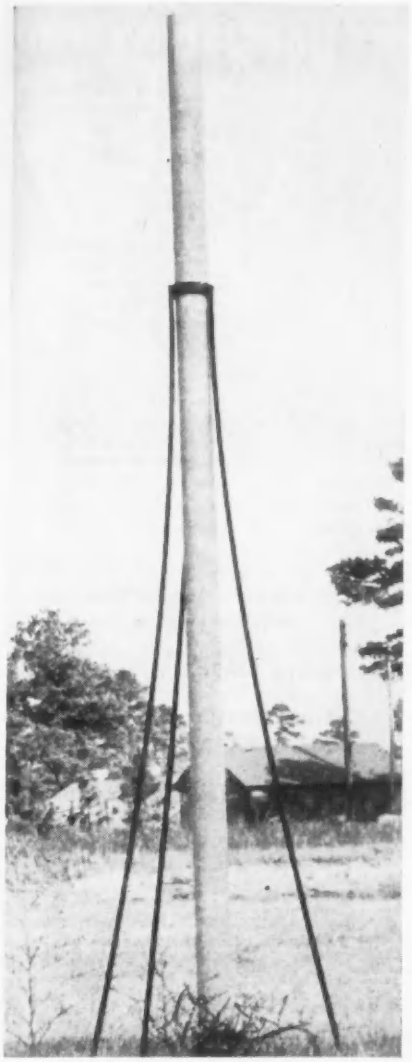


Photo Courtesy East Texas Salt Water Disposal Co.

Salt Water Line Is Vented to Air

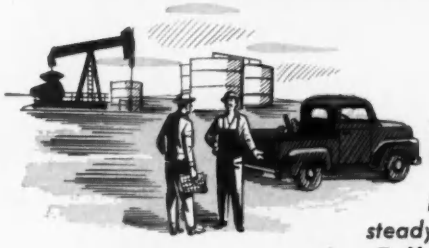
An elevated vent pipe connected into a salt water gathering line releases accumulated gases that tend to restrict the flow of water through the pipe. The salt water gathering system shown here is of the gravity type, and takes the water directly from the tank battery for treatment at a central plant prior to injection back into the formation. Where the line levels off or contains a high point, any entrained gases in the water will tend to collect at these points and remain there to restrict the flow of water through the pipe.

Asbestos-cement pipe can be used in these salt water gathering lines to eliminate the corrosion problem. In order to vent gas from the line, a vent pipe made of asbestos-cement is tied into the gathering line by means of a tee at the point of high elevation on the line where gas might accumulate.

"Best Pumps in the Oil Patch"

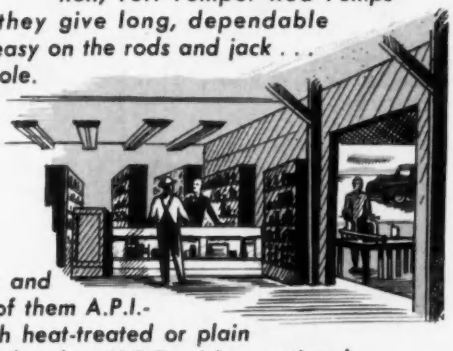
HARBISON-FISCHER

TUFF-TEMPER ROD PUMPS



ASK THE PUMPER ON THE NEXT LEASE

Let him tell you that under steady or intermittent operation, Tuff-Temper Rod Pumps run good . . . they give long, dependable service . . . they're easy on the rods and jack . . . they're no trouble in the hole.



ASK YOUR SUPPLY STORE

Check on the many types and sizes available . . . all of them A.P.I.-standard . . . all with heat-treated or plain barrels, chrome-plated or H-F Precision sectional plungers, as desired. Check on how many other operators are running Tuff-Temper Pumps.

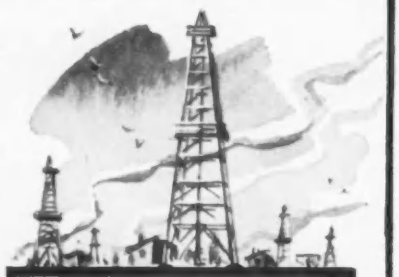
ASK YOUR PUMP SHOP — They'll tell you there's no complex mechanism to worry about . . . that Tuff-Temper Pump parts are expertly machined, finished, assembled, and carefully inspected . . . that they are easy and economical to repair.

H-F TUFF-TEMPER ROD PUMP

Run the Best:
HARBISON-FISCHER
TUFF-TEMPER
ROD PUMPS

"Best Pumps in the Oil Patch"

HARBISON-FISCHER MFG. CO. • FT. WORTH, TEXAS



SOUTH TEXAS NATIONAL BANK OF HOUSTON

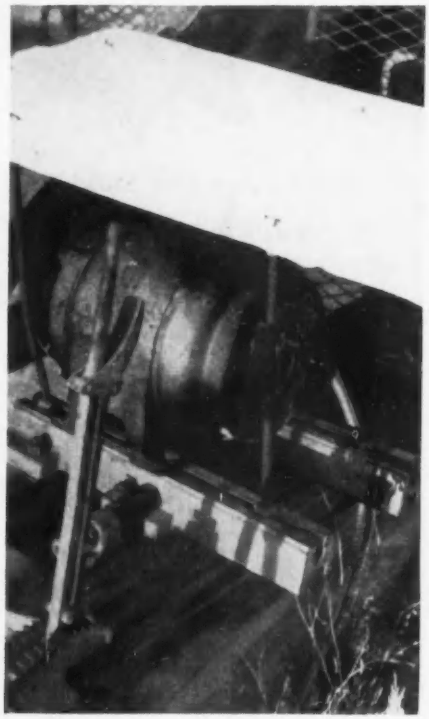
Oil PRODUCTION Loans

Complete financial services for all phases of the oil industry.

SOUTH TEXAS NATIONAL BANK

213 MAIN STREET ● HOUSTON, TEXAS
MEMBER FEDERAL DEPOSIT INSURANCE CORP.

In this case, the vent line is a 13-foot joint of four-inch asbestos-cement pipe supported by salvaged sucker rod material. Three rod legs are welded at the top to a circular ring that slips over the asbestos-cement pipe. The legs also serve as a guard for the pipe. A valve at the bottom of the vent lines permits closing the vent when desired.

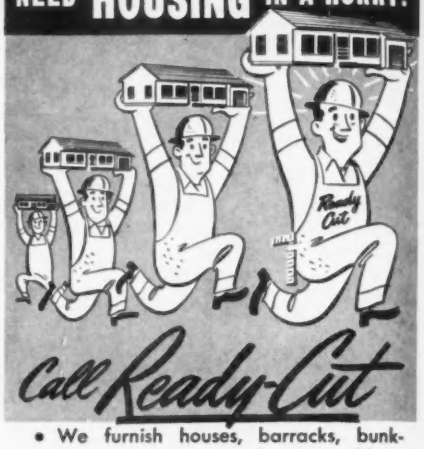


Motor Is Protected By Shelter on Rails

Protect the pumping unit motor from heavy rains or oil spray by rigging an inexpensive shelter. Utilizing the rails on which the motor is mounted, a simple support is made by bending two ½-inch rods, threaded at each end, into a U-shape, then inverting them and inserting the ends into the rail slots as shown. Nuts are drawn up to secure the rods in that position.

Over the top of these two supports lay a rectangular section of corrugated galvanized iron, the size being determined by the size motor and the room that is available between belt guards and other structures on the pumping unit base. At three points above each of the rod supports, punch holes through the galvanized iron and run a wire down to tie it to the rod, forming a hood that effectively and neatly shelters the motor.

NEED HOUSING IN A HURRY?



Call Ready-Cut

• We furnish houses, barracks, bunkhouses, supply sheds and utility buildings *ready-cut* and prefabricated for the oil industry.
• Our 1- to 3-bedroom HOUSTON HOMES are tailor-made to your requirements in any climate and available for immediate erection.
★ **PLANNING SERVICE** for one building or a complete camp.
★ **ERECTION SERVICE** anywhere, anytime.
★ **LEASE RENTAL HOUSING** details on request.

HOUSTON Ready-Cut HOUSE CO.
Prefabricators Since 1917
CABLE: REDICUT P. O. BOX 124 HOUSTON, TEXAS PHONE: FA-9365

A MILE OF OIL!

This compact little pump delivers a barrel of oil per minute at 150 pounds pressure—enough pressure to pump water or oil through more than a mile of 2" pipe.

Model 6600

- Erosion resistant synthethic rotors for dirty liquids.
- Corrosion resistant bronze construction.
- Lightweight ● Portable ● Self Priming.
- Available for Gas Engine, Electric or Belt Drive.

Proven Superiority in

BRAKE COOLING
WASH-DOWN
TRANSFER
FIRE FIGHTING
WASTE DISPOSAL

And numerous other specialized oil field pumping jobs.

AVAILABLE AT LEADING OIL FIELD STORES

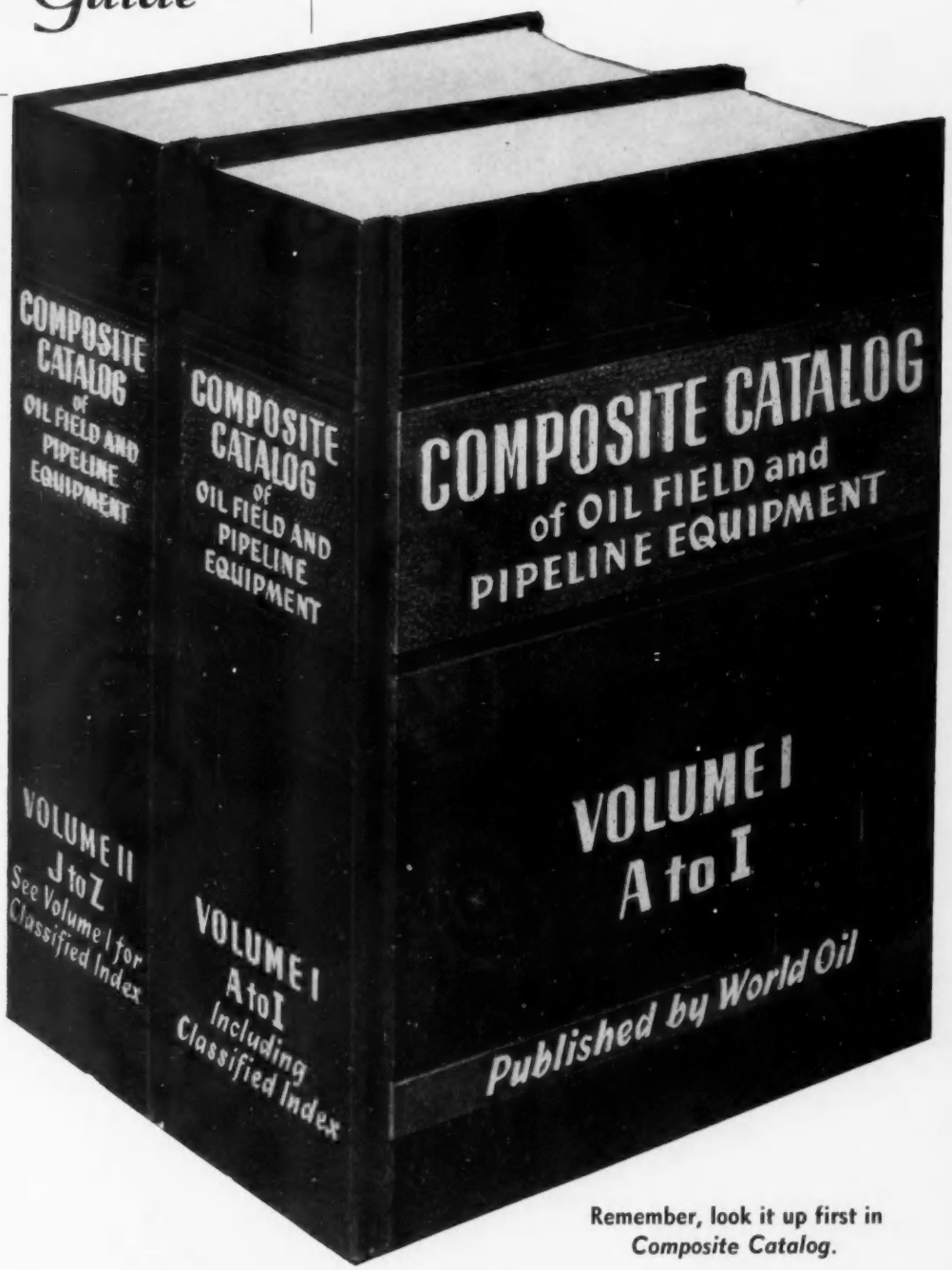
MARINE PRODUCTS COMPANY
515 LYCASTE AVE., DETROIT 14, MICHIGAN

For over 23 years—

THE UNIVERSAL OIL COUNTRY *Buyers' Guide*

For two decades, *Composite Catalog* has been the very "equipment bible" of oil field buyers. Indexed by both company and product name, the current 5,000-page edition is made up of the combined catalogs of 500 manufacturers having a common market in the oil producing and pipe line industry.

Wherever oil is produced or sought, this catalog is accepted as the standard source of buying information. You will save time and avoid errors by identifying the equipment as per page and figure numbers in *Composite Catalog*.


COMPOSITE CATALOG of OIL FIELD AND PIPELINE EQUIPMENT
VOLUME II J to Z
See Volume I for Classified Index
COMPOSITE CATALOG of OIL FIELD AND PIPELINE EQUIPMENT
VOLUME I A to I Including Classified Index
COMPOSITE CATALOG of OIL FIELD and PIPELINE EQUIPMENT
VOLUME I A to I
Published by World Oil

SEE OUR CATALOG IN THE COMPOSITE CATALOG

Watch for This Sign Of Customer Service In Oil Field Equipment Ads.

Remember, look it up first in *Composite Catalog*.

COMPOSITE CATALOG

P. O. BOX 2608 **HOUSTON 1, TEXAS**

BOOST POWER INSTANTLY with the KAAR

For greater range and clearer signals, vehicle-to-station or vehicle-to-vehicle, the *new* Kaar Power Booster will increase the power output of any 10 watt mobile transmitter *six times* without increasing the standby battery current.

Here's how it works:

1. Insert Power Booster between low power transmitter and antenna.
2. Select power needed by switch on dashboard.
3. Push microphone button to go on the air *instantly* with added power.

Using an Eimac 4-65A tetrode, the Power Booster is "Instant Heating"—does *not* draw power from battery until microphone button is pushed. Selector switch on dashboard simply puts Power Booster in readiness. (Note: The added power is used *only* when needed—thus conforming to the FCC good engineering requirements.)

Use the Kaar Power Booster with any mobile transmitter operating in the 152-174 mc band and enjoy mobile communication excellence never before attained. (Another Kaar Power Booster will soon be available for use in the 25-50 mc band.)

WRITE TODAY FOR COMPLETE INFORMATION!

KAAR ENGINEERING CORP

KAAR ENGINEERING CORP.
Middlefield Road, Palo Alto, Calif.

OTHER PRODUCTS OF THE KAAR ENGINEERING CORP.

The "Radiopak," mobile and station radiotelephone transmitters and receivers for 1.6-6 mc, 25-50 mc, 152-174 mc bands. Also manufacturers of marine radiotelephones, direction finders, depth sounders.

Steel Pipe Ladder Aids in Servicing

A short, sturdy ladder made from steel pipe makes the inspection and servicing of stationary engines easier and safer. A small, all-steel platform was erected on both sides of the large diesel engine pictured and a railing of rod steel was welded to this platform. A short ladder was built with two-inch pipe serving as legs and steel plates making the footing pieces. Pedestals for each step were provided by welding short vertical sections of one-inch pipe to the legs. The formed metal plates, about 5 by 24 inches, were tack welded to the pedestal and to the leg. In this manner, a sturdy ladder can be made for use in a steep position.

The ladder top hooks onto the platform frame so that it may be removed when cleaning or painting the station floor. The ladder is equipped with its own hand railing welded at top and bottom to help support the station engineer going up or coming down the ladder.

This type shop-made ladder was standardized for each engine in the compressor station, thereby simplifying their fabrication. The foot plate on each step was color-coded as an added safety measure.

AN OPEN LETTER TO EVERY INDUSTRY THAT NEEDS YEAR TO YEAR ENGINE DEPENDABILITY AND ECONOMY

Gentlemen:

As distributors of history making Climax Blue Streak Engines, we take a great deal of pride and satisfaction in knowing that our customers are being furnished with the most dependable and economical industrial engine ever manufactured. Moreover, the addition of this proved line of modern gas power equipment and parts means that our organization can now supply you every power and service requirement...whatever your operation may be.

From Climax Blue Streak Engines you may expect reliable performance under the most difficult operating conditions because they were designed with durability in mind. What is more, these compact units will operate with equal efficiency on either Butane or Natural Gas.

We are anxious to explain the many more advantages of Climax Engines and how they can help increase the efficiency of your operation. Furthermore, you will want to know more about our complete maintenance and service facilities that provide immediate low cost attention to your every power need. Call or write today.

YOUR CLIMAX BLUE STREAK ENGINE ORGANIZATION.

Wilson Engine & Equipment Co.
Bakersfield, Calif.
Long Beach, Calif.
San Francisco, Calif.

Vern Walton Company
Casa Grande, Ariz.
Coolidge, Ariz.
Phoenix, Ariz.
Mariana, Ariz.
Willcox, Ariz.

Harry Cornelius Co.
Albuquerque, N. Mex.

Equipment Supply Co.
El Paso, Texas
Dell City, Texas
Van Horn, Texas
Pecos, Texas

Diesel Equipment Co.
Wichita, Kansas
Great Bend, Kansas

Diesel Power, Inc.
Perryton, Texas
Amarillo, Texas
Firona, Texas
Plainview, Texas
Clovis, N. Mex.

Diesel Power Company
Fairview, Okla.
Miami, Okla.
Tulsa, Okla.
Oklahoma City, Okla.
Duncan, Okla.

Stewart & Stevenson Services, Inc.
Lubbock, Texas
Odessa, Texas
Midland, Texas
Wichita Falls, Texas
Dallas, Texas
Longview, Texas
San Antonio, Texas
Corpus Christi, Texas
San Juan, Texas
Brownsville, Texas
Houston, Texas

Lewis Diesel Engine Co.
No. Little Rock, Ark.
Memphis, Tenn.

United Tool Company
Shreveport, La.
Monroe, La.

Taylor Machine Works
Jackson, Miss.
Louisville, Miss.

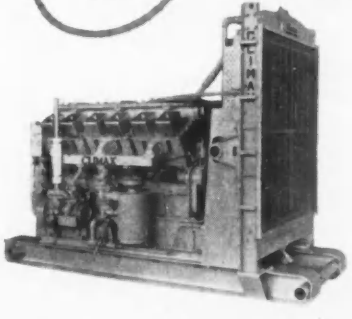
George Engine Co., Inc.
Lake Charles, La.
Houma, La.
Golden Meadow, La.
Morgan City, La.
Delcambre, La.
Empire, La.
Baton Rouge, La.
Vicksburg, Miss.
Harvey, La.

NEW DISTRIBUTOR LOCATIONS BEING ESTABLISHED

Northwestern Division
Edmonton, Canada
Calgary, Canada
STATES
Washington, Oregon, Montana, Idaho, Wyoming, Nevada, Utah, Colorado, North Dakota, Nebraska

Central and Southeastern Division
STATES
Georgia, Florida, Illinois, Indiana, Kentucky, Ohio, Pennsylvania, West Virginia, Virginia, Alabama, North Carolina, South Carolina

climax

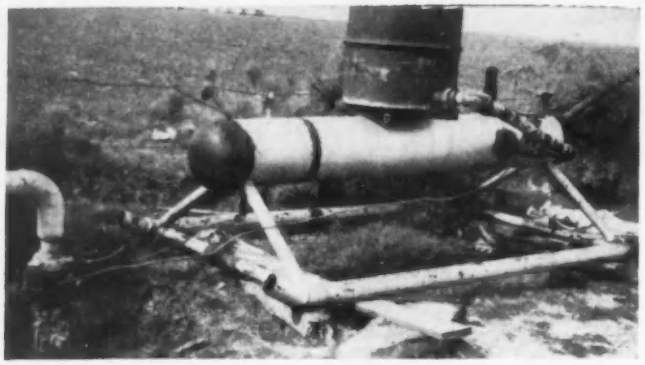


BLUE STREAK ENGINES

Made by Climax Engine and Pump Mfg. Co.
Factory and General Offices: Clinton, Iowa
Oil Field Sales Office:
155 Continental Ave., Dallas, Texas

Lubricator Combats Corrosion

To inject caustic soda or other inhibitors in the gas line, a simple device made of scrap material may be used. At the point of injection, a skid-mounted vessel is set up so the inhibitor will run by gravity into the lease line. Two copper tubings are used so that the pressure can equalize in the vessel and the force of gravity cause the inhibitor to run into the line.

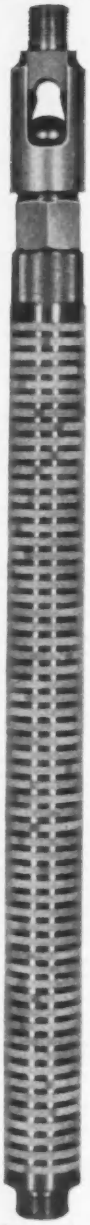


A simple device for mixing the inhibitor with water consists of a steel drum mounted on the top of the pressure vessel with a connection from the bottom of the drum to the side of the chamber. The bulk inhibitor is put into the drum, mixed thoroughly with water and all the pressure released from the chamber. The valve is opened to allow the contents to run into the vessel. The valves are then closed, the copper tubing valves opened and the sight feed on the discharge line adjusted to the required amount of chemical needed to protect the lines.

Skid-mount the device to make it movable from place to place on the lease or to various leases of the operator.

ECONOMY DOLLARS!

So FEW can SAVE so MANY!



For just a few dollars more you can have a

MARTIN PLUNGER

1. It repairs for 1/3 to 1/4 the cost of a new plunger.
2. Lasts for years.
3. Gives longer runs and therefore less pulling cost.
4. Saves 50% to 80% on barrel or tube cost.
5. Increases production in many cases.

Our 1953 Catalog explains the simple requirements for getting these results. Just drop us a line for a copy.

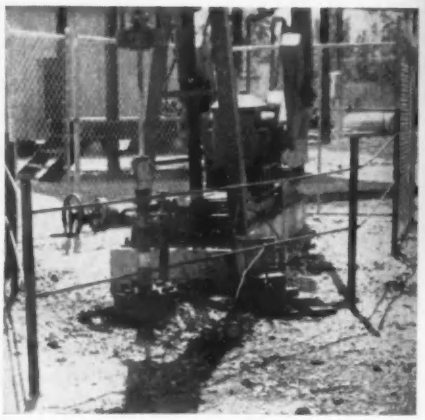
Sold thru supply companies

FIELD REPRESENTATIVES (Manufacturers Agents):
E. W. Brockman, Tulsa, Okla., Phone 7-7477
H. G. Crider, Ardmore, Okla., Phone 2941
J. L. Davis, Houston, Tex., Phone MO-4891
Tom (W. D.) Hulett, El Dorado, Ark., Phone 3-4545
John B. Leland, Wheatridge, Colo., Phone Arvada 489R
Red (L. K.) Martin, Corpus Christi, Tex., Phone 2-5317

JOHN N. MARTIN
MANUFACTURER

Patent No. Re20574

9 W. Brady St., Tulsa, Okla. Tel. 4-9415



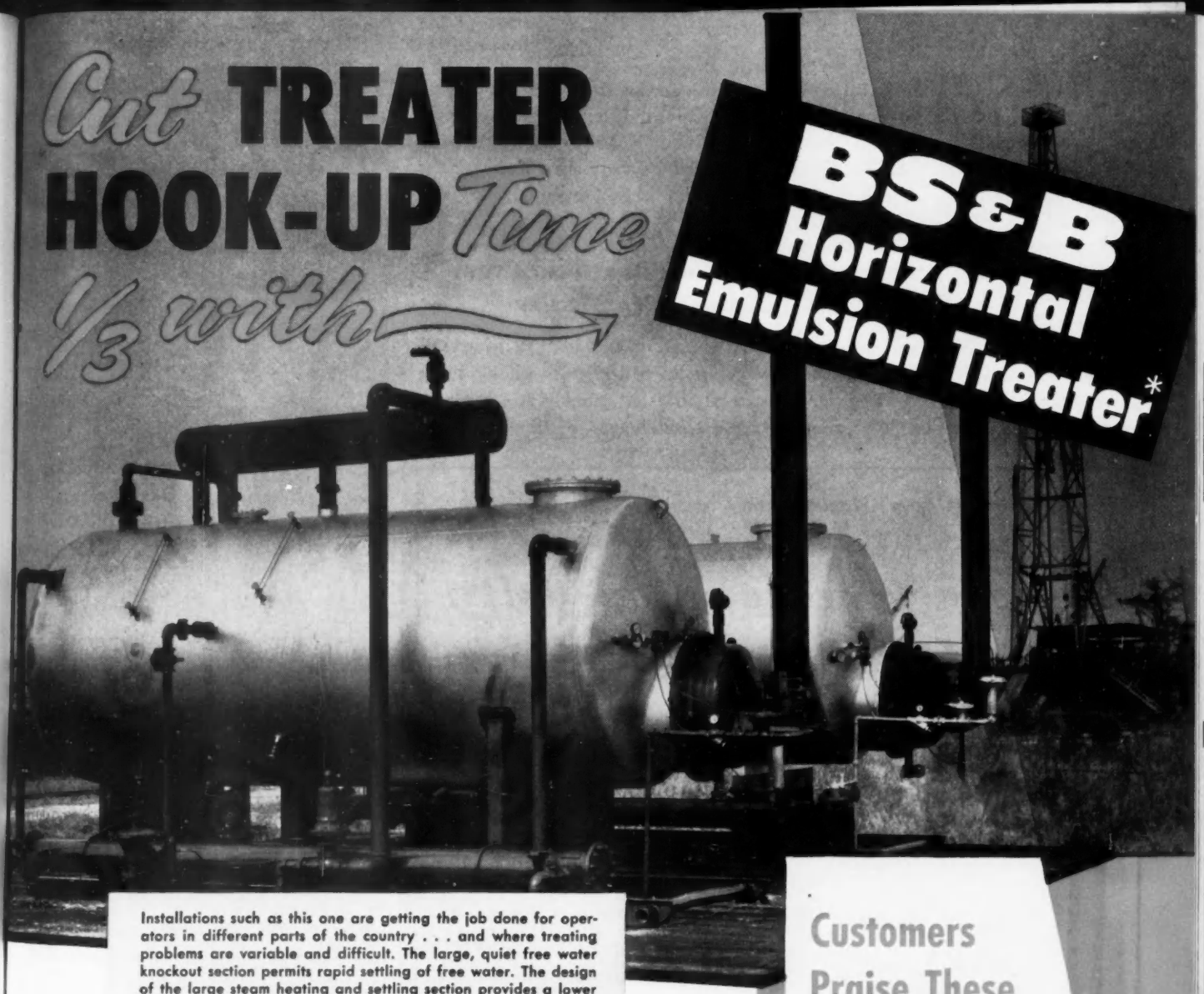
Combination Fence Guards Pumping Well

A combination sucker rod enclosure and a conventional chain link fence surrounding a pumping well can provide adequate protection and accessibility. Because the well in the photograph was located near a residential area, it was necessary to erect a protective enclosure which prevented unauthorized personnel from getting injured or livestock from getting under the counterbalances.

Similarly a permanent type fence can be built to surround the rear part of the pumping unit and can be equipped with a gate to enable the pumper to get in and out of the enclosure easily. From a point beginning near the rear of the unit, and extending out front of the well to form a V-shaped enclosure is a sucker rod

Cut TREATER HOOK-UP Time 1/3 with →

BS&B Horizontal Emulsion Treater*



Installations such as this one are getting the job done for operators in different parts of the country . . . and where treating problems are variable and difficult. The large, quiet free water knockout section permits rapid settling of free water. The design of the large steam heating and settling section provides a lower water level—thus a larger oil heating and settling space. The closed system steam chest means the heating unit is free from sedimentation and caking trouble since the hot surface of the firetube is never in contact with the oil or salt water . . . burnouts and loss of firebox efficiency are eliminated.

Customers report that BS&B's Horizontal Emulsion Treater cuts average hook-up time to 1/3, as compared to other types and makes of treaters. This is possible since the only connections necessary are the oil inlet and outlet and the gas outlet. Connections are provided for fuel gas supply and to equalize the diaphragms of the OWC valves to the treater gas space. Treater is easy and quick to set, requiring minimum foundation, especially when purchased with skids.

BS&B made the steam chest practical and efficient. If you require average treating temperatures (110 to 160°F) and if corrosion is a problem or you've had serious burnouts better see your BS&B representative. He wants to talk . . . you'll be money ahead to listen.

*Patent Pending

Customers Praise These Other BS&B Advantages

1. **Low fuel gas consumption**
2. **Lower treating temperatures**
3. **Ease of installation**
4. **Large settling space**

BLACK, SIVALLS & BRYSON, INC.
Oil & Gas Equipment Division, Dept. 1-B6
2131 Westwood Blvd. Oklahoma City, Oklahoma

EFFICIENCY BS&B RELIABILITY
OUR 60TH YEAR

fence. This enclosure is made by driving short lengths of 2½-inch tubing into the ground at 6 to 8-foot intervals. Tops of these sections are flush with the ground level.

A removable guard rail is made by welding two courses of sucker rod to vertical two-inch pipe which forms the legs that can be inserted into the 2½-inch foundation members set in the ground. When it is necessary to pull the well, the sucker rod enclosure can be removed quickly by two men and set aside to allow the pulling unit and crew full access to the well. Replacing the enclosure after the job is completed is simple. Since the rods bend easily, fitting the upright legs into the foundation section is not difficult.

Shop-Made Skimmer Adjusts Vertically

Made from the bonnet of a salvaged gate valve, this oil skimmer can be adjusted quickly and easily to any desired height within the limits

of the valve stem. This skimming pit receives salt water from the gun barrels of several tank batteries and permits the fluid to settle so that oil will rise to the top where it is skimmed off and treated.

To take off oil and no water, it is essential that the overflow level of the skimmer be slightly above the water-oil contact in the settling pit. Since this level may fluctuate from month to month, some means must be provided for adjusting the skimmer in accordance with the fluid level in the pit.

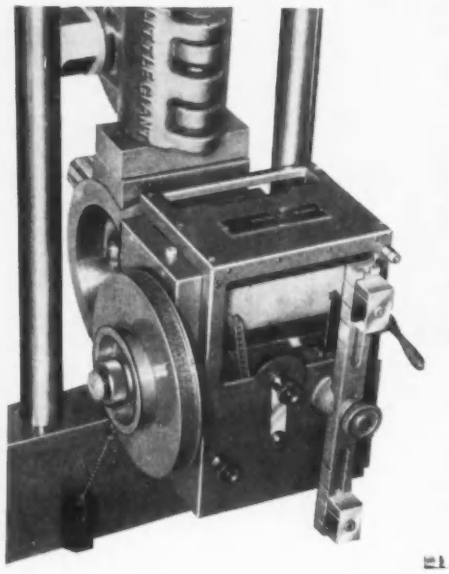
This shop-made skimmer is fabricated from salvaged parts and performs the job satisfactorily. Principle of operation is identical with other gravity skimmers, in that the top layer of oil is allowed to overflow into a sump where it is picked up by a pump and transferred to a treating tank.

The skimmer bowl is made from a quarter section of casing closed in at each end to form a trough. It is supported by a vee bracket welded to the bottom end of the valve stem. This stem screws into the bonnet of a salvaged gate valve which includes

KNOW THE FACTS...

Improve Your Pumping Wells!

J-F DYNAMOMETER *tells how* . . .



. . . production is increased with operational control! The J-F Dynamometer enables checking of pumps at surface; reduces number of sucker rod failures by determining the most favorable operating speed and stroke. It reveals poor counterbalance, thus extending the life of the prime mover and gear box; aids the operator in selecting proper equipment. Decreased downtime and fewer pulling jobs mean more production at less expense.

J-F DYNAMOMETER WIDELY ACCEPTED!

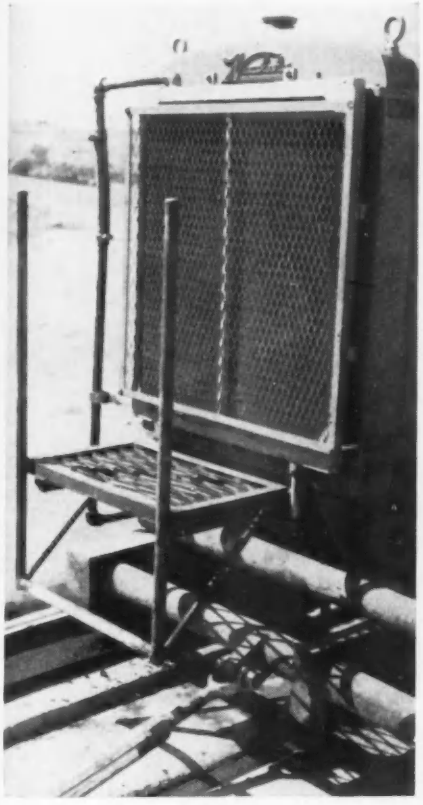
The effectiveness of the J-F Dynamometer is proven by the fact that it is one of the few instruments of scientific control so widely used on pumping wells. The chief reason is that the J-F Dynamometer is simple to use and may be operated by non-technical personnel.

JOHNSON-FAGG

Engineering Company

3920 South Peoria — Tulsa, Oklahoma

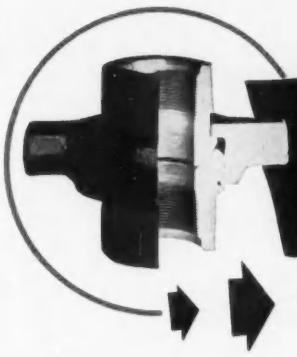
the valve stem handle, not shown. The bonnet is mounted on a bracket extending from the edge of the settling pit so that it is within easy reach of the pumper. By turning the hand wheel in either direction, the skimmer can be raised or lowered by small increments to any desired level. Oil skimmed in this manner flows through a flexible hose attached to a short nipple welded to the bottom of the trough. Skimmed oil flows into a small sump where it is picked up by a transfer pump.



Step-Platform Aids In Radiator Check

To provide a step and small platform to aid the pumper when he checks or refills the engine radiator on a long-stroke hydraulic pumping unit installation, one company designed an efficient, yet easily-built assembly. Since it is common on units of this type to skid the entire engine and pump assembly back on greased channel iron rails when the well is pulled, the conventional step or platform normally installed on the ground is not practical.

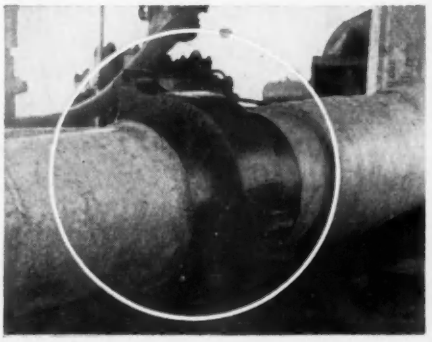
The assembly pictured is simple in



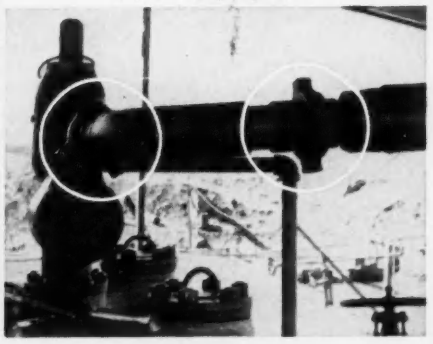
A TOUGH UNION for Tough Service . . .

. . . . the WECO FIG. 400

4000 p.s.i. Test
Sizes: 2", 2½", 3", 4", 5½" O.D., 6", 7" O.D., 8", 10"



The Weco Fig. 400 is ideal for pump suction connections.



Weco Fig. 400 unions save time in connecting up pump discharge lines.

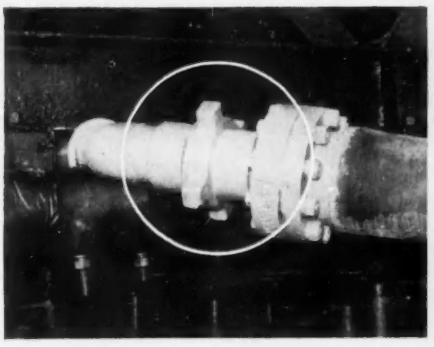
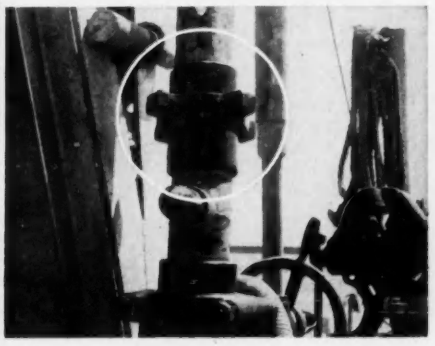


Fig. 400 Union on mud line.



4" Weco Fig. 400 Union on stand pipe.

● Unions in service on drilling rig lines get a lot of rough treatment. These mud, steam, water, oil, gas and other lines are made up and broken out frequently . . . carry fluids at high pressure with lots of vibration. The WECO Fig. 400 Union withstands more abuse in these tough services than any other union. Thicker sub end walls resist distortion . . . provide greater strength with less weight. The famous Weco ball and cone seat assures a perfect seal, every time.

SOLD EXCLUSIVELY THROUGH SUPPLY STORES

P.E.S.A. PARTNERS IN PETROLEUM PROGRESS

It's Wise to Standardize with . . . WECO . . .

WELL EQUIPMENT MFG. CORP.
Division of Chiksan Company
HOUSTON 1, TEXAS
CHIKSAN COMPANY
Brea, Calif. Chicago 28, Ill. Newark 2, N. J.
CHIKSAN EXPORT COMPANY, Brea, Calif. Newark 2, N. J.

Manufacturers and Distributors of Oilfield, Refining, Marine and Industrial Equipment

Buy
A
ALTEN
PUMPING UNITS
for . . .
BEST HELICAL GEARS
COMPLETE PRETESTING
HARDEST GEAR SURFACES
You can avoid shutdowns before they occur and roll up more income producing hours if you pump with Alten units. Each is thoroughly pre-tested before being shipped to the field. And that's only part of the story. Specially hardened Alten helical gears are the best ever developed for pumping purposes. Get enduring service at full rated capacity—buy Alten at your supply store.
—ALTEN—
Foundry & Machine Works, Inc.
LANCASTER, OHIO
SALES OFFICES
Lancaster, Ohio
Olney, Illinois
Hutchinson, Kansas
Duncan, Okla.
Abilene, Texas
Houston, Texas
Casper, Wyoming
Edmonton, Alberta, Canada
EXPORT OFFICE
New York City
WAREHOUSES
Lancaster, Ohio
Wichita Falls, Texas
Houston, Texas
Casper, Wyoming
Edmonton, Alberta, Canada

design, consisting of two one-inch pipe uprights which serve the dual purpose of hand rails and as support for the rung of the one-step ladder going up to the expanded steel platform. The unit is welded to two two-inch angle-iron extensions which project out from beneath the engine mount. Of all-welded construction, the platform is well braced and is of a design that lends itself to production in the welding shop for installation on this and other types of pumping units.

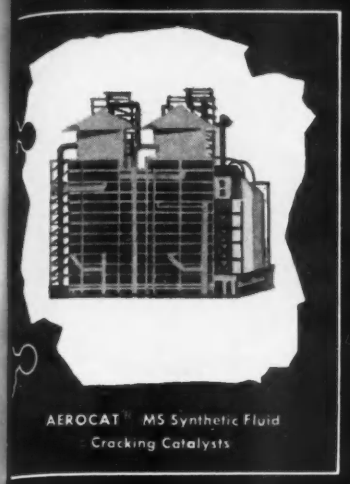
Anchor System Aids Pump Installation

An inexpensive, time-saving method of locating and anchoring a newly-installed pumping unit is one that permits use of more than one size unit should changing well conditions demand it.

Before the concrete pad is poured, two lengths of salvaged casing, of approximately six inches in diameter, and of a length equal to the anticipated length of the pumping unit base, are laid out parallel to the axis of the unit. They are positioned, however, a foot or so out from the center lines of the two I-beam skid base members of the pumping unit base. Prior to laying them in their permanent position, a series of slots of about one-inch in width, spaced at regular intervals previously determined according to the particular unit to be set on the well, are cut in the top surface of the two parallel lengths of casing. Pieces of scrap material, or reinforcing steel are welded to the sides and under surfaces of the two lengths of pipe in order to firmly anchor them when the concrete is poured around them.

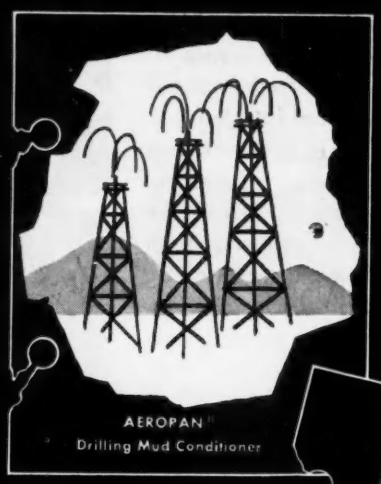
The two lengths are so positioned that the upper surfaces will be from ½ to 1 inch below the finished surface of the concrete pad. Before concrete is poured, pieces of tar paper or building paper are placed over the slots to prevent their being filled with cement.

When the slab is completed and the pumping unit is skidded into position, workmen determine where anchor bolts are to be located and the appropriate slot, or slots, are opened by the simple expedient of cracking away the thin layer of cement overlying the



AEROCAT® MS Synthetic Fluid Cracking Catalysts

Specialty Catalysts



AEROPAN® Drilling Mud Conditioner

AEROLUBE® Additives

depend on CYANAMID service

to meet your chemical requirements

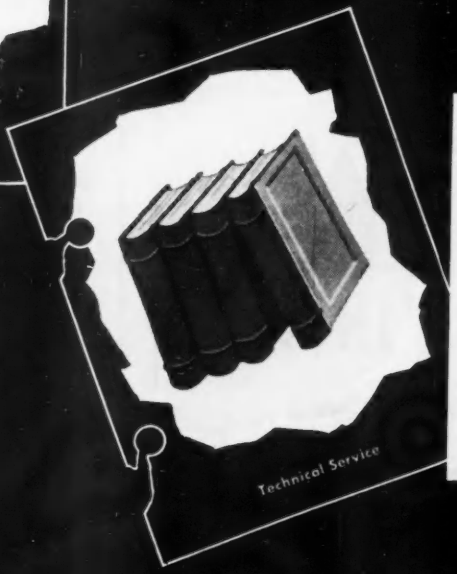
An important part of Cyanamid's integrated service to the petroleum industry is its ability to meet the chemical requirements of the industry's every phase.

Cyanamid Chemicals range from drilling mud conditioners to specialty catalysts and lube oil additives. Each is the result of continuing basic research by Cyanamid's Refinery Chemicals Department — and of the knowledge gained in the field by Cyanamid's specialists.

Cyanamid Chemicals today are contributing to the improvement of many types of petroleum products.

One example: Cyanamid Gelling Agents for the lubricating grease manufacturer embody the latest advances in scientific research, among which is greatly improved gel stability obtained by replacement of a small part of the stearic acid with dimer acid. Standard ASTM and SOD tests also show improved yield and resistance to mechanical breakdown of aluminum greases produced with these new gelling agents.

Gelling Agents



Technical Service

AMERICAN Cyanamid COMPANY

REFINERY CHEMICALS DEPARTMENT, DIV. WO6
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

In Canada: North American Cyanamid Limited, Toronto and Montreal

desired openings. The 7/8-inch bolts, previously prepared as shown, with an "eye" bent into the end to be inserted into the anchor, then are inserted into the slots, turned through 90 degrees and nuts then turned down to secure the horizontal bar laid across the pumping unit base members. Such bars, or flattened lengths of tubing such as that shown in the installation, are positioned at two or more points along the length of the pumping unit.

A principal advantage of this system lies in the ability to quickly remove the anchor bolts whenever the unit has to be shifted or exchanged for another size unit. As soon as the new position, or that of the new unit, is determined, the appropriate slots are opened and anchor bolts again installed.

The method requires a minimum of crew time in the field and permits a well to be taken off and put back on production in only a fraction of the time ordinarily required if a new pad has to be poured, or adapted to a different-sized unit, or anchor bolt holes drilled in the old base. The small amount of time required for preparation of the two lengths of pipe is more than offset by subsequent savings of crew and truck time when the pumping unit is installed.

Made for Your Well!

With 22 models to choose from, you can select a JENSEN PUMPING UNIT that will fit your production requirements as perfectly as any custom-made unit could. Why be satisfied with misfits when you can have a JENSEN! Save money. Save power. Save time and temper. Resolve right now to standardize on JENSEN PUMPING UNITS . . . at least investigate the facts!

JENSEN
BROS. MFG. CO., INC.
Coffeyville, Kansas, U.S.A.
EXPORT OFFICE: 50 CHURCH STREET, NEW YORK CITY

Share an idea and make some easy money!

• Do you have a plan or device that proved to be a timesaver on the job? Here's a chance to share your idea with others . . . and collect on it. Take a picture of the timesaver and send it to us with a written description . . . Address your hints to the Production Editor, WORLD OIL, Post Office Box 2608, Houston 1, Texas.

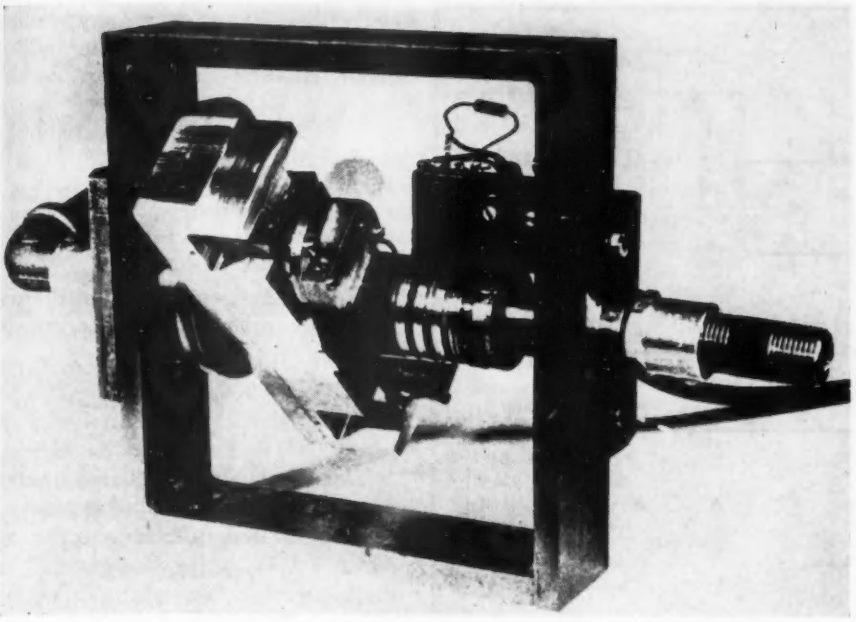


FIGURE 1. The new flowmeter.

This New Flowmeter Measures True Mass-Rate

A linear, bi-directional meter that records flowing liquid per unit of time.

By Y. T. LI and P. A. LAPP
Massachusetts Institute of Technology

A NEW FLOWMETER that measures true mass-rate independent of any physical properties of the flowing liquid has been developed. The meter is linear, bi-directional and can be calibrated without passing fluid through it. Its speed of response is exceptionally high and it is capable of measuring an accurate average for pulsating flows.

There has long been an acute demand for an instrument that can measure actual mass of fluid that is carried past it per unit time. Almost all commonly used flowmeters are designed to measure the volumetric flow of fluids. When mass flow is required, it is necessary to know the fluid density, variations of which can cause extreme difficulty. A knowledge of mass flow is vital in many applications.

When the flow-rate changes rapidly with time, it is sometimes important to know the instantaneous flow-rate. A flowmeter with insufficient speed of response will produce large dynamic errors. Applications in jet and rocket engine research, as well as in the petroleum industry, are increasing the demand for flowmeters with fast response speeds.

The new meter possesses a high speed of response, and is capable of measuring instantaneous flow-rates at speeds up to several hundred cycles per second. In addition, its output varies linearly with flow-rate, thus making possible the measurement of the average flow under pulsating conditions.

Currently Available Flowmeters. The constant-area, variable-head class of flowmeters, often called headmeters, are perhaps most widely used. The orifice, venturi and flow-nozzle meters belong to this class. This type of flowmeter measures the pressure drop across a fixed restriction in the flow path. The inherent nonlinearity between flow-rate and pressure drop seriously restricts the usable range of operation, and causes acute difficulties in measuring rapidly varying flows.

The inherent nonlinearity of the headmeter is overcome in another class of flowmeters which maintain the pressure drop constant across a variable restriction in the flow path. The area of the restriction is a linear function of the volumetric flow-rate.

The output of both these types of flowmeters is highly dependent on the viscosity, temperature and compressibility of the fluid. Also, the fluid density must be known if mass flow is required.

More elaborate volumetric flowmeters measure the speed of a flow-actuated turbine or positive displacement motor. Again, the fluid density is required to obtain mass flow.

One type of mass-rate flowmeter has been designed which utilizes the Magnus principle: Two passages are formed in the fluid stream by introducing a cylinder in the middle of the stream, rotating at constant speed about an axis perpendicular to the flow direction. The flow is thus divided into two equal passages formed between the cylinder and wall of the instrument chamber. It can be shown, assuming several ideal conditions, that the pressure difference between these two flow passages is a linear measure of mass flow.[5] Unfortunately, actual operating conditions deviate considerably from the ideal assumptions, so that the meter requires careful calibration and knowledge of certain properties of the fluid.

Consequently, currently available flowmeters leave much to be desired if mass flow is to be measured efficiently, with sufficient speed of response.

Principle of Operation of the True Mass-Rate Flowmeter. The true mass-rate flowmeter measures the moment required to apply a Coriolis acceleration to the fluid stream. As in

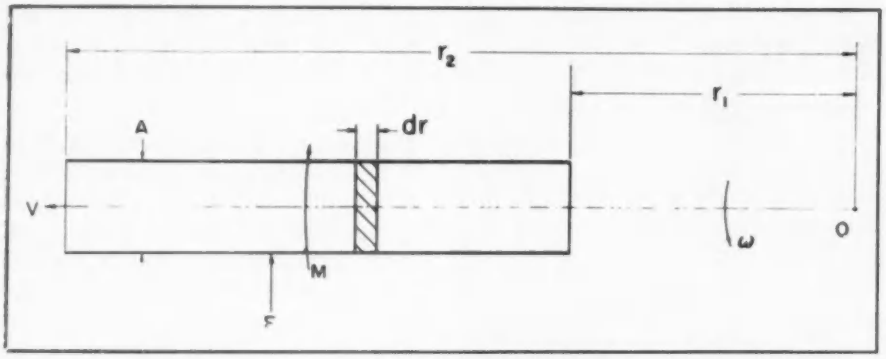


FIGURE 2. Force and moment produced by Coriolis acceleration.

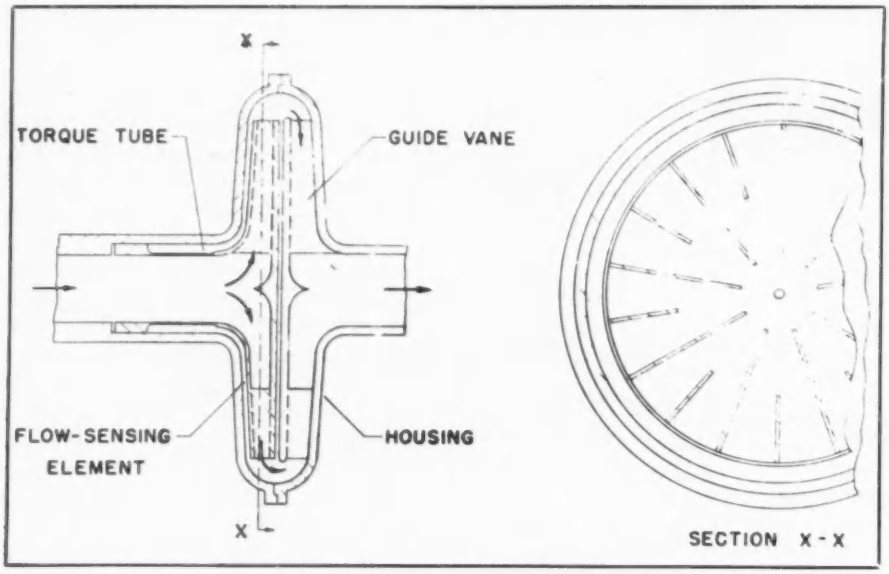


FIGURE 3. Impeller-type mass rate flowmeter.

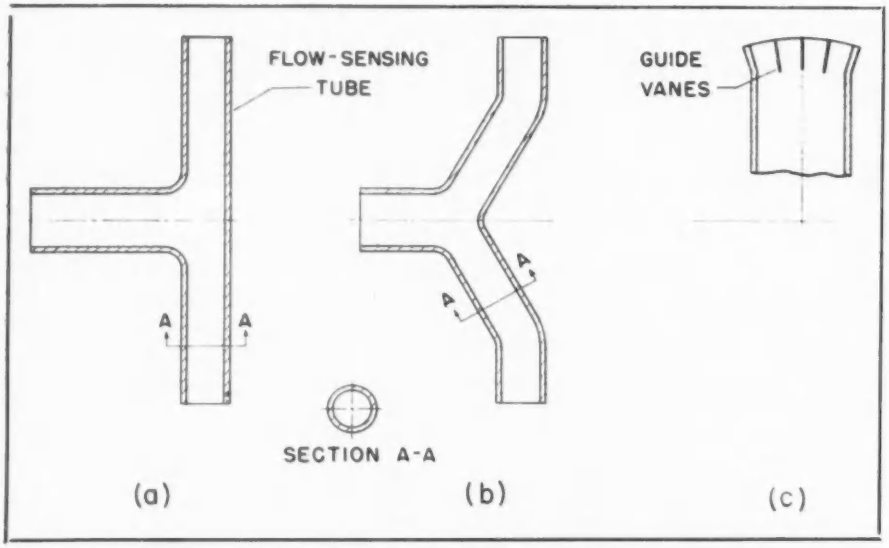


FIGURE 4. Flow-sensing elements: (a) T tube, (b) Y tube, (c) guide vanes.

Figure 2, the fluid is assumed to flow uniformly through a straight tube; each fluid particle moves parallel to the others and rotates at a constant angular velocity w about an axis through O, intersecting the tube axis at right angles. The fluid moves with a velocity V, and is subject to a uniform Coriolis acceleration given by:

$$a = 2Vw \qquad (1)$$

The total force acting on the wall of the tube, in a direction perpendicular to its axis, between the radii r_1 and r_2 is:

$$F = \int_{r_1}^{r_2} 2Vw\rho \; A \; dr = 2VA\rho (r_2 - r_1)w = 2w(r_2 - r_1)W \qquad (2)$$

where

ρ = Fluid density
A = Cross-sectional area of tube
W = Mass flow-rate

The net moment acting on the tube about O produced by the moving fluid is:

$$M = \int_{r_1}^{r_2} 2Vw\rho \; Ar \; dr = VA\rho (r_2^2 - r_1^2)w = w(r_2^2 - r_1^2)W \qquad (3)$$

Thus both the force and moment acting on the tube are linear functions of the mass flow-rate through the tube which serves as the flow-sensing element.

It can be shown that Equation (3) is independent of the shape of the flow-sensing element and the nature of the fluid and flow pattern within the element.[5] It is only necessary to ensure that the entrance and exit velocities of the fluid be radial with respect to the rotating flow-sensing element. The fluid entering and leaving the element will then have no tangential component of velocity, i.e., the entrance and exit flow velocity vectors both pass through the axis of rotation O. Under this condition, no additional moment will be produced by tangential velocity components.

One practical arrangement using this principle consists of an impeller connected by a torque tube to a housing, as shown in Figure 3. The housing is rotated at constant speed (gearing and motor not shown) and is connected to the stationary flow passage at both ends by suitable rotary seals.[4] Attached to the impeller are guide vanes which provide radial inlet and outlet fluid velocities. The Coriolis moment is transmitted by the impeller guide vanes to the torque tube which elastically deflects with respect to the housing. The elastic deflection of the torque tube, which may be measured with a wire strain-gauge or similar device, is a linear measure of the Coriolis moment and hence the mass flow-rate.

The torque required to rotate the fluid is recovered in the impeller guide vanes, so that the driving motor need supply only the torque necessary to overcome bearing and seal friction and windage. The output signal is inde-

pendent of this frictional torque. This device can be used bi-directionally since reversed torque results from reversed flow. The scale factor is determined by the motor speed.

Several experimental models have been constructed and tested with excellent results. One is described later in this article.

The Flow-Sensing Element. The flow-sensing element must impart a known velocity change to the fluid, by diverting it in a radial direction from the axis of rotation. It must also possess a small polar moment of inertia about the axis of rotation, be compact and simple in construction, and produce a minimum of pressure drop in the fluid stream.

The impeller-type just described possesses a rather large polar moment of inertia. A simple T tube, shown in Figure 4a, has a comparatively smaller polar moment of inertia, simple construction, and is more compact. The pressure drop associated with the sharp bends can be reduced by using a Y tube, shown in Figure 4b. Guide vanes, as shown in Figure 4c, should be used if there is danger of tangential fluid velocity with respect to the flow-sensing element; this particularly applies in the case of short, wide tubes. Since r_1 is usually much smaller than r_2, guide vanes are normally used only for the outlet flow. An error of 10° in the exit angle, from purely radial flow, produces only a 2 to 3 percent flow measurement error for the model herein described.

The speed of response of the flowmeter varies directly as the natural frequency of the flow-sensing element. For the T tube of Figure 4a, the natural frequency can be shown to be:[5]

$$f_n = \frac{1}{2\pi} \cdot \frac{3}{2} \cdot \sqrt{\frac{Vwr_m}{d_{max} r_2 \left(1 + \frac{\rho_t A_t}{\rho A}\right)}} \quad (4)$$

Where:

- V = Fluid velocity
- w = Angular velocity of the flow-sensing element
- r_m = Radius at which the force-sensing element is attached to the flow-sensing element
- d_{max} = Maximum deflection of the force-sensing element
- r_2 = Exit radius of the flow-sensing element
- $\rho_t A_t$ = Mass per unit length of the tube wall
- ρA = Mass per unit length of the fluid

Consequently, for a high speed of response, the angular and flow velocities should be high, and the deflection of the force-sensing element should be as small as possible. The latter requirement is best fulfilled using mechano-electric transducers, where d_{max} need never exceed 0.001 inch.

The natural frequency of the flowmeter to be described is approximately 600 cps.

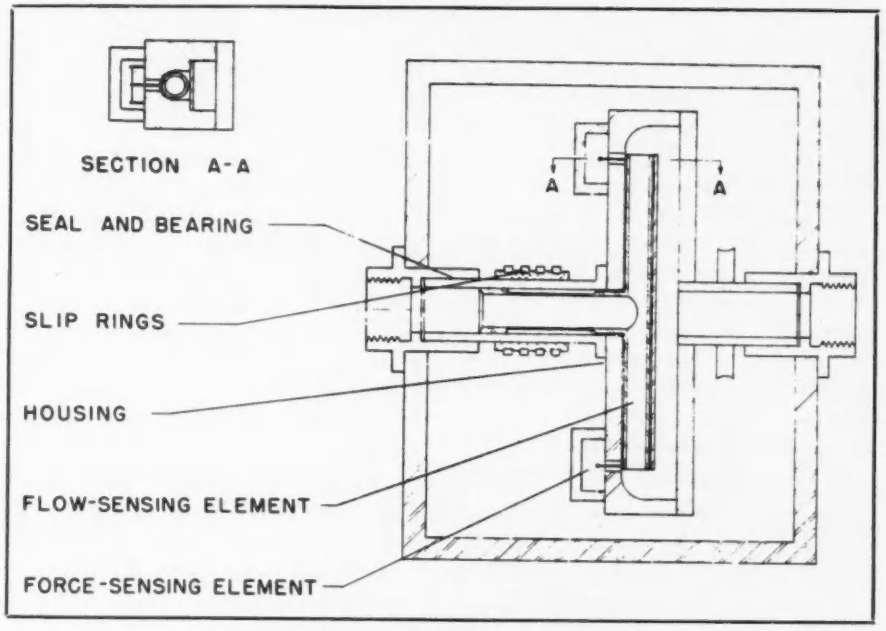


FIGURE 5. Schematic section of model flowmeter.

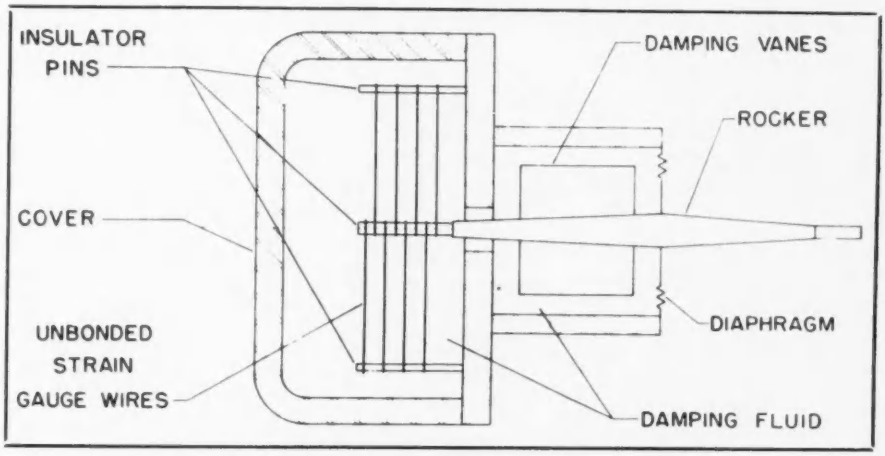


FIGURE 6. Force-sensing element used on model flowmeter.

Description of an Experimental Model. The model to be described was constructed to test the theory and supply information for future designs. It has a five-inch diameter rotor, rotating at 1800 revolutions per minute, with a flow capacity of 5 to 10 gallons per minute of water. The flowmeter is shown in Figures 1 and 5.

The flow-sensing element consists of a T tube enclosed in a heavy, rectangular housing, similar to a sector of the impeller-type previously described. The rotary seals and shaft bearings are precision-bored cast-iron bushings with just sufficient clearance to permit ease in rotation.

The construction of the force-sensing element is shown in Figure 6. The strains in the flow-sensing tube are transmitted by a rocker arm to unbonded strain-gauge wires, which are mounted in a container external to the fluid being metered. The insulator pins are rigidly connected to the housing so that the strain-gauge wires measure the relative deflections of the flow-sensing tube. A small flexible diaphragm supports the rocker arm to which damping vanes are attached. The complete strain-measuring capsule is filled with a viscous fluid which provides damping, protection of the

strain-gauge wires from corrosion, and aids in dissipating heat generated by the measuring current.

Two such strain-measuring capsules are mounted symmetrically on the flow-sensing element. The electrical and mechanical symmetry of the instrument make the strain-gauge bridge quite insensitive to internal pressure changes. The meter is stable, compact and rugged; tests have shown that the output is almost unaffected by pressure and temperature variations.

Flowmeter Performance.

STATIC PERFORMANCE: The static sensitivity of the flowmeter depends on two factors: The relation between generated torque and mass flow, and the relation between electrical output and generated torque. The former depends on the geometry and rotational speed, and should be constant for any particular meter. The latter can be measured using an artificially produced torque. The meter can thus be calibrated without passing a known fluid through it.

Theoretical and experimental static calibrations are presented in Figure 7, which verify that the meter output is independent of fluid density and viscosity. The instrument could be used equally well with gases; however, this particular model was designed for liquid flow.

DYNAMIC PERFORMANCE: The dynamic performance of the flowmeter was tested by attempting to apply a sudden rise in mass flow. The results indicated a close agreement with the predicted natural frequency of 600 cps. The meter was also tested with flows in which strong pulsations were superimposed on a steady component. Under these conditions, it is usually desired to measure only the true average flow.[3] The average value of the meter output, in this circumstance, indicated less than 2 percent error for flows with large-amplitude pulsations as high as 100 cps.

Current Development. Mass-rate flowmeters, for use in high pressure applications, must transmit the Coriolis force, generated inside the flow-sensing element, to an external transducer. A force-transmitting device has been developed which serves to separate the signal element from direct contact with the fluid and transmits the small Coriolis force independently of fluid pressure.

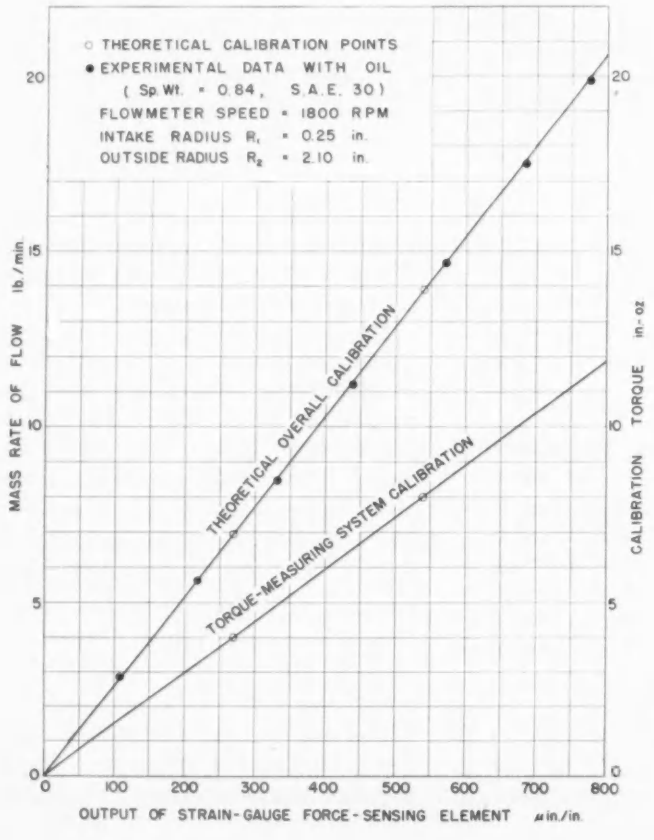


FIGURE 7. Flowmeter calibrations for steady-flow conditions.

This device makes possible a mass-rate flowmeter capable of measuring fluid at 3000 pounds per square inch over a temperature range from —65° to 250° F, with a natural frequency of 600 cps. Another flowmeter is being designed to measure the flow of a steam and coal powder mixture, in a 1-to-1 ratio, in an eight-inch diameter pipe, at a rate of 30,000 pounds per hour.

Development is also being directed toward the design of improved rotary seals to withstand higher pressures with lower friction.

Conclusions. The flowmeter described in this article is capable of measuring the true-mass flow linearly and independent of pressure, viscosity, density and temperature. The fluid may be inhomogeneous; multi-phase fluids or mixtures of liquids and solids may be measured with equal ease. The meter is bi-directional and may operate over a wide range of flow-rates due to its linearity. Calibration may be made without passing known flows through the meter, and this calibration is valid for any fluid that is capable of passing through the instrument. The scale factor is easily shifted over a wide range by changing the rotational speed. The meter introduces only a small pressure drop in the fluid stream, has a very high speed of response and is capable of indicating an accurate average for pulsating flows.

The output of the flowmeter is electrical in form at present, but could be a pneumatic or mechanical signal with some loss in speed of response.

The mass-rate flowmeter thus answers the demand for an instrument capable of measuring true-mass flow. Future development in the design and use of this instrument is predicted to cover even broader ranges of application than are herein presented.

BIBLIOGRAPHY

[1] "Fluid Meters, Their Theory and Application," A.S.M.E. Research Publication, 1937.

[2] "Electromagnetic Blood Flowmeter," by J. W. Clark and J. E. Randall, Rev. Scientific Instruments, **20**, p. 951, 1949.

[3] "The Mass Flow Meter, A Method for Measuring Pulsating Flow," by D. Brand and L. A. Ginsel, Instruments, **24**, p. 331, 1951.

"A Flowmeter Designed to Measure Mass Flow by Direct Calibration," by S. M. Tennant and J. R. Turner, M.S. Thesis in Mechanical Engineering, Massachusetts Institute of Technology, 1950.

[4] "Mechanical Seals," by D. R. Lewis, Machine Design, **18**, p. 125, 1946.

"Sealing a Rotary Shaft Metal Bellows Construction," by R. Hammond, Chemical Age (London), **55**, p. 199, 1946. "Hydraulic Seals," by F. Flick, Machine Design, **20**, p. 139, 1948.

[5] "A Fast-Response True-Mass-Rate Flowmeter," by Y. T. Li and S. Y. Lee, A.S.M.E., (publication date not yet known).

Slugging it out with desert dust

THERE'S a section of the new Salt Lake-Boise pipeline near Mountain Home, Idaho, that offers as tough working conditions as you'll find anywhere.

The line, being built by Engineers Ltd. Pipeline Co., runs through desert terrain where blowing dust and sand batter against the tractors. Air cleaner sediment cups have to be emptied four to six times a day. Yet the 26 pieces of Cat* equipment on the job have stood up to the beating with practically no down time.

Some idea of the dust is shown in the picture above, where a Caterpillar D7 Tractor with No. 7A Bulldozer is backfilling the trench.

The owners like the steady-going production of their Cat earthmovers under conditions that would stop other machines dead in their tracks. And the operators like the handling ease of the angle-'dozers—their precise blade control and simple adjustment for changing blade positions.

Ask your Caterpillar Dealer for an on-the-job demonstration of the stamina and economy that have made these big yellow bulldozers famous. He backs every product he sells with reliable service and parts.

Caterpillar Tractor Co., Peoria, Illinois.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks—®

NAME THE DATE... YOUR DEALER WILL DEMONSTRATE

Buckeye Pipe Line Company's Delaware River crossing from the east bank.

Buckeye Pipe Line Company . . . 67 Years Old and Still Growing

SIXTY-SEVEN YEARS OLD and still growing. That is the story of Buckeye Pipe Line Company, whose origin dates back almost to the beginning of pipe line transportation.

The system is not too old for further growth, however, and this fall will have ready for operation the final spread of its most recent expansion project, the 370-mile, $24 million Eastern Products Pipe Line System. This 10-, 14- and 16-inch system will collect refined products in the New Jersey refinery and deep water terminal area and move them westward to Allentown, Pa., and thence northward to upstate New York. At a point near Auburn, N. Y., one branch will extend westward to Caledonia and another will run eastward to Syracuse.

Operations commenced early in 1953 on the first leg of this system from Linden to Allentown where deliveries are made to Tuscarora Pipe Line Company. Other delivery terminals on the portion of the line north of Allentown will be at Scranton, Pa., Binghamton, Liverpool, Syracuse, Waterloo and Caledonia, N. Y. At the latter terminus, the line will connect with Buffalo Pipe Line Corporation for shipments to Buffalo and Rochester.

The Linden-Allentown segment of the line is 16-inch. A 14-inch line will extend from Allentown to Auburn and the two branches from the latter point will be 10-inch line. Present pump stations are located at Linden and Macungie (near Allentown). Other stations will be located near Lehighton and Nicholson, Pa., and Auburn. Shippers expected to use the Eastern Products System when completed are: American Oil Company, California Oil Company, Cities Service Oil Company, Crown Central Petroleum Corporation, Esso Standard Oil Company, Gulf Oil Corporation, G. L. F. Farm Supplies, Hartol Petroleum Corporation, Sinclair Oil Corporation, Shell Oil Company, The Texas Company and Tide Water Associated Oil Company.

7250 Miles of Line. Addition of this products system will give Buckeye and its subsidiaries, Northern Pipe Line Company and New York Transit Company, Inc., approximately 7250 miles of crude oil, products and gathering lines, ranging from 2- to 22-inch diameter. This will make Buckeye the largest independent common carrier system, which extends from the Atlantic seaboard and northern New York across the northern U. S. as far west as Griffith, Ind., and Lawrenceville, Ill.

Buckeye's 3564-mile trunk crude carrier consists of 6- to 22-inch line starting in the East Chicago area at Griffith and extending to Buffalo. It serves refineries in such major consuming areas as East Chicago, Detroit, Toledo and Cleveland. The eastern portion of this crude line passes through the Pennsylvania area where oil was first discovered in the U. S. and where Buckeye's predecessor companies first moved Bradford crude southward to Pittsburgh. Other lines in the area were built in the '70s and '80s from New York's Allegany County to Olean and Buffalo. Many of these first lines were short carriers and a number of them were acquired by National Transit Company and later by New York Transit.

The trunk line receives most of its crude from connecting pipe lines serving Illinois, Mid-Continent, Texas and Wyoming fields. Buckeye also owns and operates a gathering system of 2957 miles of 2- to 6-inch lines and storage facilities in northeastern and southeastern Ohio.

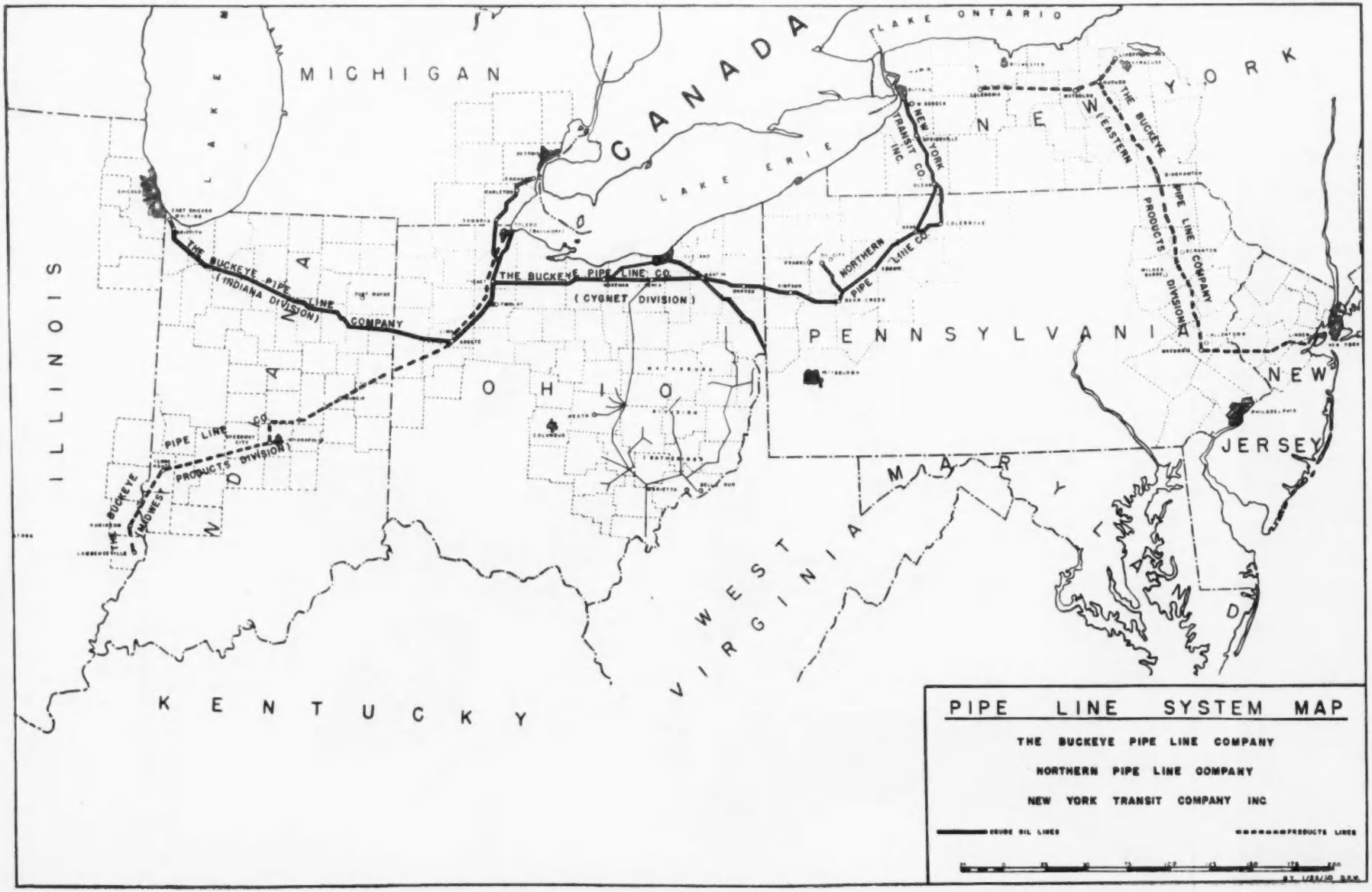
An 8-inch products line, the Midwest Products Division, runs from Robinson and Lawrenceville, Ill., eastward to Toledo, with intermediate terminals at Indianapolis and Muncie, Ind., and Lima, Ohio. The portion of this line from Lima to Toledo was completed in 1952 by conversion of an existing 8-inch pipe line from crude to products service.

Still Growing. Further expansion of the Midwest Products Division is under consideration. Nearing completion is an expansion of crude oil pumping capacity at Lima. Installation of two electric pumping units totaling 2000 horsepower will boost pumping capacity of the station to 500,000 barrels daily, one of the largest pumping stations in the country. Present capacity at Lima is in excess of 400,000 barrels daily which is maintained with 10 diesel pumping units totaling 6766 horsepower. The Buckeye system in 1952 had total deliveries and transfers of crude and products of 197,779,329 barrels.

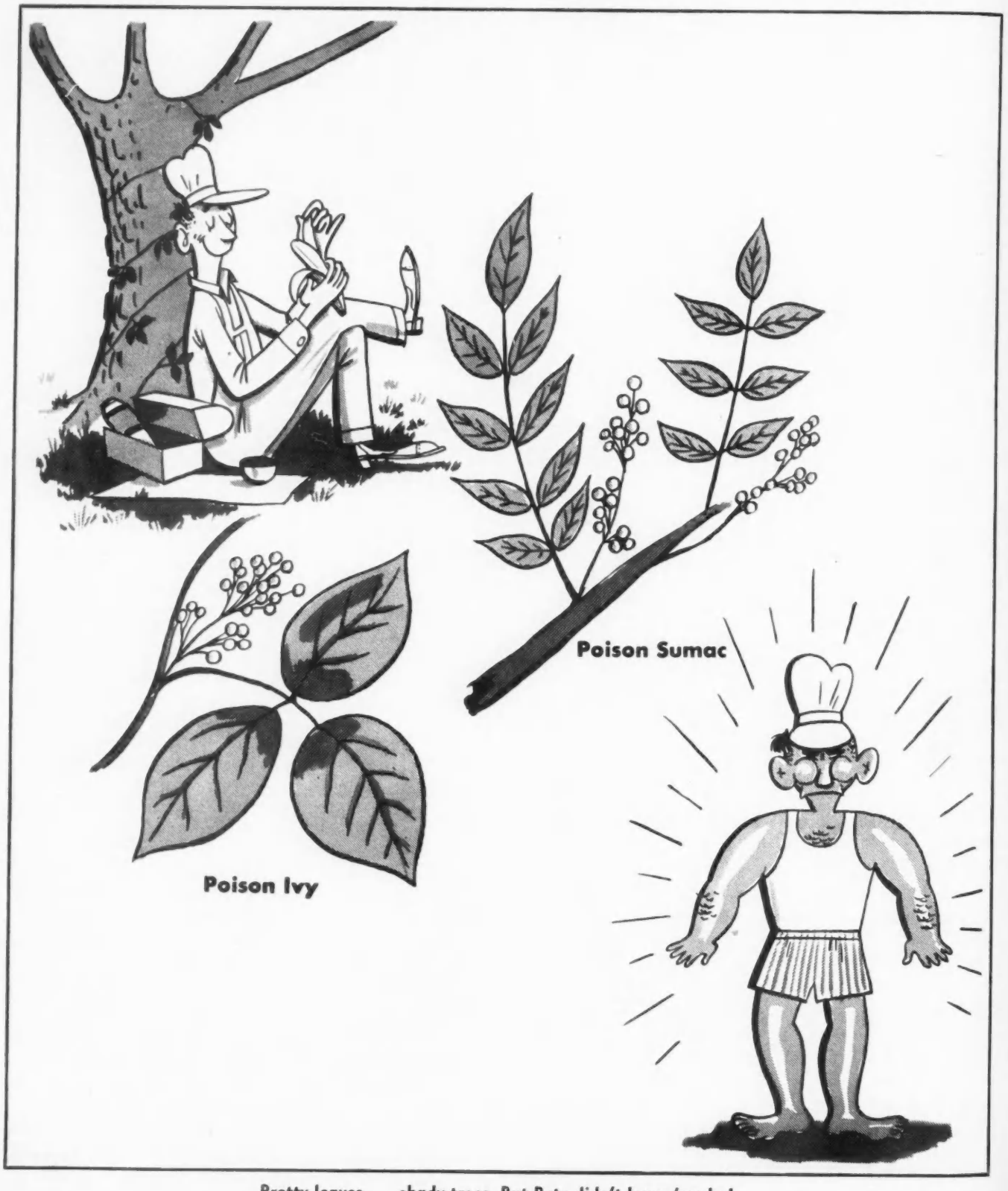
No. 7 of a Series

BUCKEYE PIPE LINE COMPANY

Map of the Month



Perils of Pipeline Pete



Pretty leaves . . . shady trees, But Pete didn't leave 'em be!

Rules of Thumb

FOR THE PIPELINER'S NOTEBOOK

These formulae from the pages of engineers' own notebooks yield rough, but reasonably accurate answers for design, maintenance and supply questions. Use them for quick calculations to solve your everyday pipe line engineering problems. If you have a pet Rule of Thumb, share it with others by sending it to Donald M. Taylor, Pipe Line Editor, WORLD OIL, P. O. Box 2608, Houston 1. The rules are being numbered according to subjects to aid classification when published in book form and to help you, the reader, file them in your notebook.

Engineering Design —5—How much pipe length is lost in making up screwed joints?

Screw-coupled line pipe is sold on the basis of twenty-foot joints, the length being measured to include a coupling on one end. When the pipe is made up, there is a loss in length at each joint. For sizes three inch and above, all of which have a standard eight threads per inch, the following rules may be used. In each case "D" represents the nominal diameter in inches.

(1) 0.57 + 0.04 D = correction in percentage;
(2) 30.1 + 2.11 D = correction in feet per mile;
(3) 361 + 25.3 D = correction in inches per mile;
(4) 68.4 + 4.8 D = correction in inches per 1000 feet.

Example: In ordering four inch screw-coupled pipe:
0.57 + 0.04 × 4 = 0.73% extra should be ordered;
30.1 + 2.11 × 4 = 38.5 feet per mile;
361 + 25.3 × 4 = 462 inches per mile;
68.4 + 4.8 × 4 = 87.6 inches per 1000 feet.

The above rule is adequate for standard weight pipe; there is some variation, especially in the larger sizes, for extra heavy and for very light weight pipe.

Engineering Design —6—How to determine the buoyancy of bare steel pipe?

Multiply the square of the outside diameter of the pipe, in inches, by 0.341, and subtract the pipe weight in pounds per foot; the answer is the buoyancy per foot in fresh water.

Example: 12" (12.75" O. D.) 33.4 pound pipe (¼" wall).

Buoyancy = $12.75^2 \times 0.341 - 33.4$
= $162.56 \times 0.341 - 33.4$
= 53.8 − 33.4 = 20.4 pounds per foot.

Since all of the coating materials in common use are heavier than water (but not as much so as steel), coated pipe will have less buoyancy than indicated by the rule. For sea water, use 0.350 for the constant.

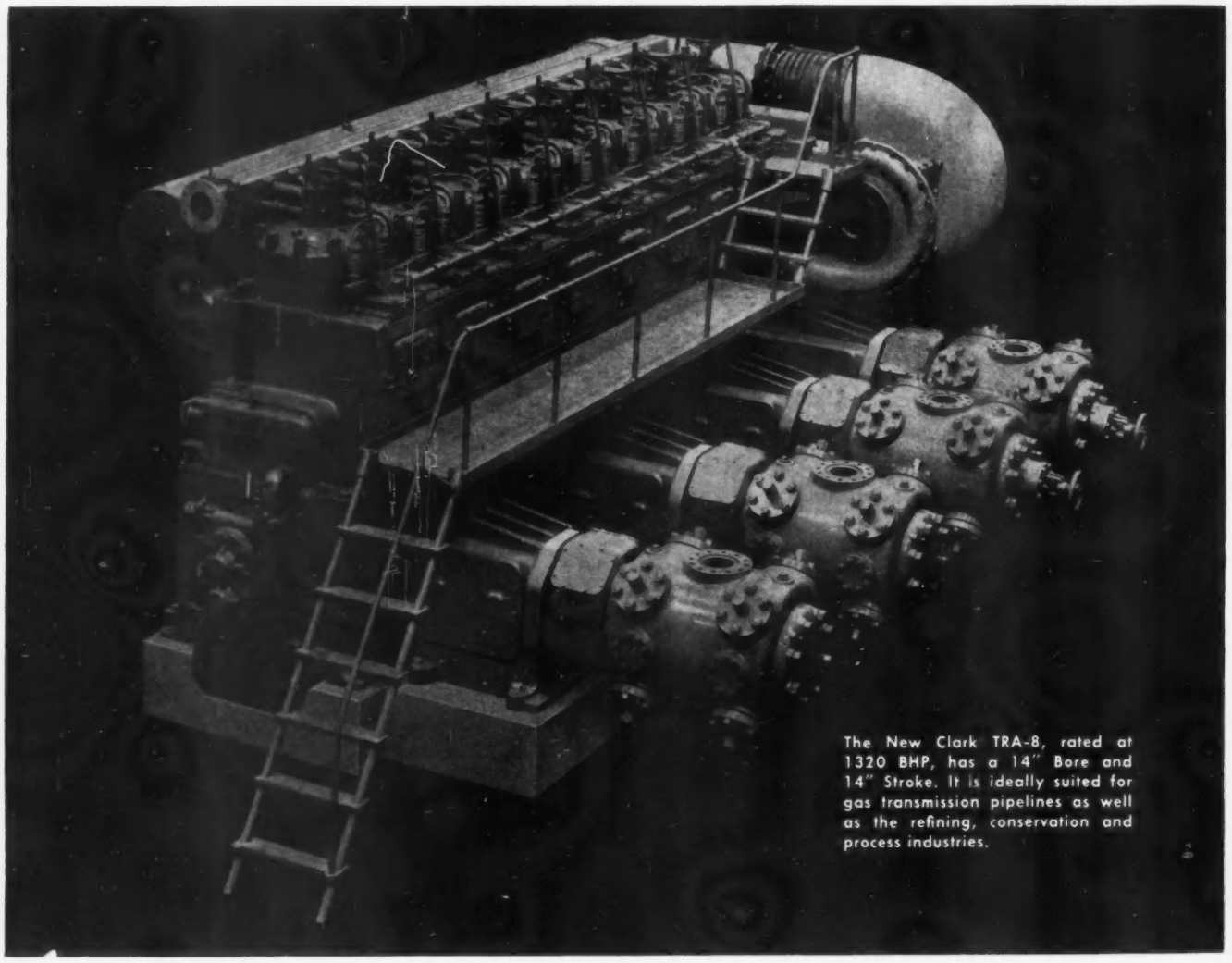
Corrosion Protection —7—How can the current output of magnesium rod used for the cathodic protection of heat exchanger shells be predicted?

Divide the total dissolved solids content of the water by 13; the answer is the current output per foot of 1.315" (1" pipe size) magnesium rod to be expected.

This is an approximation to the current flow which will be found after stabilized conditions have been reached, if protection is obtained. If insufficient magnesium is installed, the current flow will probably be greater, and if too much is installed, the current will be less.

ITS HERE!

The NEW Clark 2-Cycle



The New Clark TRA-8, rated at 1320 BHP, has a 14" Bore and 14" Stroke. It is ideally suited for gas transmission pipelines as well as the refining, conservation and process industries.

Clark Continues to Set the Pace in Compressor Progress

revolutionary compressor development!

Turbo-Charged "Right Angle"

It's here — after seven years of intensive development. Clark revolutionizes compressor design with the first 2-Cycle Turbo-Charged Gas Engine Driven Compressor . . . the TRA. Another Clark first! A precedent-shattering development that makes possible —

50% MORE POWER

Developing 1320 bhp, the TRA-8 delivers 50% more power than any comparable compressor, with *no* encroachment on overload carrying ability.

SHARPLY REDUCED FUEL CONSUMPTION

The TRA is conservatively rated *and guaranteed* to burn substantially less fuel than *any* gas engine driven compressor now built.

25% LESS COOLING WATER LOAD

(Including scavenging air intercooler load.) Vast amounts of waste heat are recovered from the exhaust gases by the Clark Turbo-Charger and are converted to useful work.

FLAT FUEL CONSUMPTION CURVE

Fuel consumption remains practically constant over a wide range of load conditions.

QUIET

Energy goes into power, rather than noise. Much quieter than a conventional gas engine driven compressor. No exhaust pulsations.

UNPRECEDENTED RUGGEDNESS

Tremendous stamina, unapproached by any other compressor design. Conservative BMEP rating.

COMPACT IN-LINE DESIGN

Very economical of floorspace, foundations and building requirements, yet highly accessible.

●

The Clark TLA, with 17″ bore and 19″ stroke, is also available when units of even greater horsepower than the TRA are required. For complete engineering details — the facts behind this revolutionary compressor development — see your nearest Clark representative and write for Bulletin 130.

CLARK BROS. CO. • OLEAN, N. Y.

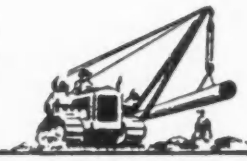
DIVISION OF DRESSER OPERATIONS, INC.

SALES OFFICES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

CLARK compressors

© 1953, Clark Bros. Co., Division of Dresser Operations, Inc.

PIPE LINE *Construction*



By **THERESA K. MARTIN,** WORLD OIL Staff

Plantation Pipe Line Plans Products Carrier Extension

The Plantation Pipe Line Company announced it will extend its 14-inch diameter pipe line from Charlotte to Greensboro, N. C. The 82-mile extension with related facilities will cost approximately $4.5 million and is scheduled for completion the latter part of this year.

Plantation Pipe Line Company owns and operates a pipe line system for the transportation of refined liquid petroleum products as a common carrier under Interstate Commerce Commission regulations. The products transported are used principally by the motoring public, trucks, tractors, diesel railroad engines, farm equipment, and for miscellaneous industrial and domestic heating purposes in six of the Southeastern states.

The extension of the line into Greensboro, along with recently constructed booster stations, will permit increased pumpings out of Baton Rouge from around 210,000 barrels of oil per day to around 225,000 barrels.

Platte Pipe Line Starts Big Horn Basin Expansion

Construction has started on Platte Pipe Line Company's $3 million extension into the Big Horn Basin of Wyoming. The extension, which will consist of 38 miles of 12-inch line from Byron to Oregon, Wyo., and 59 miles of 14-inch line from Oregon to Platte's Chatham Station, is being built by R. H. Fulton and Company of Lubbock, Texas.

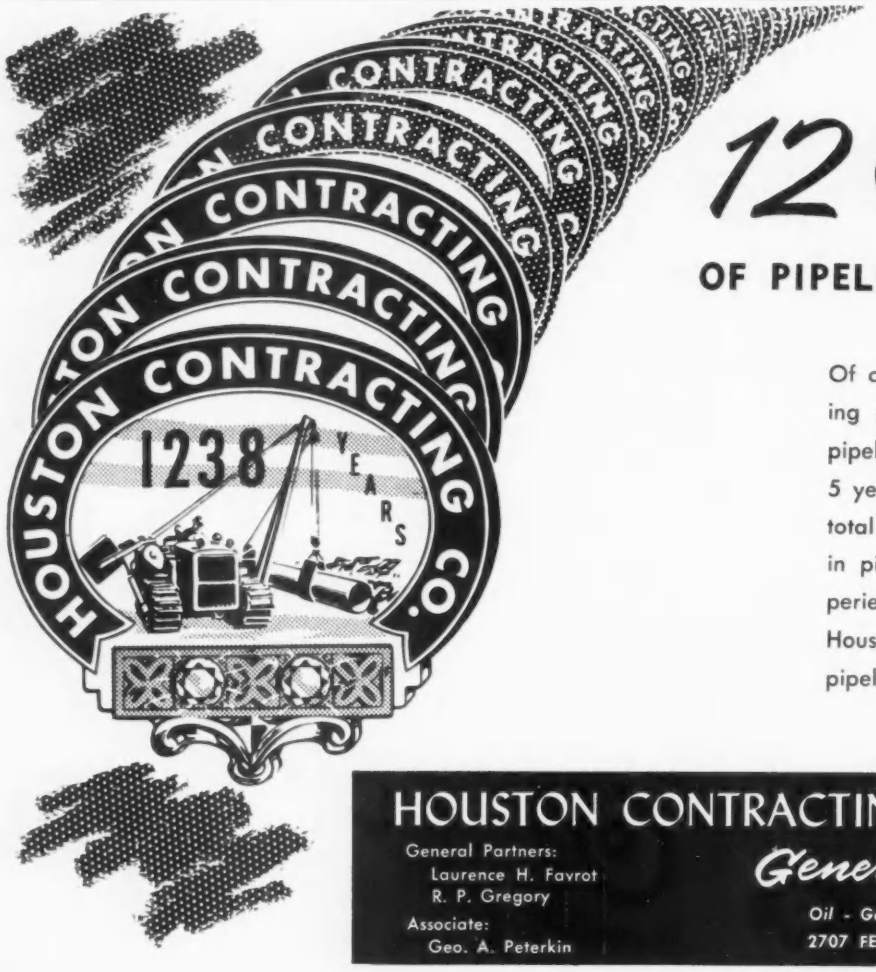
Platte Pipe Line Company recently put in operation its new $60 million, 20-inch diameter, crude line.

Utah Natural Gas Will Build $4 Million Transmission Line

Utah Natural Gas Company will begin construction as soon as possible on a $4 million natural gas transmission line from the Clear Creek field in Carbon County, Utah, to Orem, 40 miles south of Salt Lake City.

Permission for the 56-mile, 18-inch line was granted by the Utah public service commission. Under a 20-year contract, also approved by the commission subject to minor modifications, Utah Natural Gas has agreed to deliver to Mountain Fuel Supply Company 50 million cubic feet daily upon completion of the line and another 50 million upon development of sufficient reserves.

Utah Natural Gas is controlled by El Paso Natural Gas Company which purchased 66⅔ percent of the company's stock last winter.



12 Centuries

OF PIPELINING EXPERIENCE

Of course, we haven't been building pipelines that long — but 146 pipeliners who have been with us 5 years or more have a combined total of 1238 years of experience in pipe line construction. This experience is an integral part of Houston Contracting's facilities for pipeline construction.

HOUSTON CONTRACTING COMPANY LTD.

General Partners:
Laurence H. Favrot
R. P. Gregory
Associate:
Geo. A. Peterkin

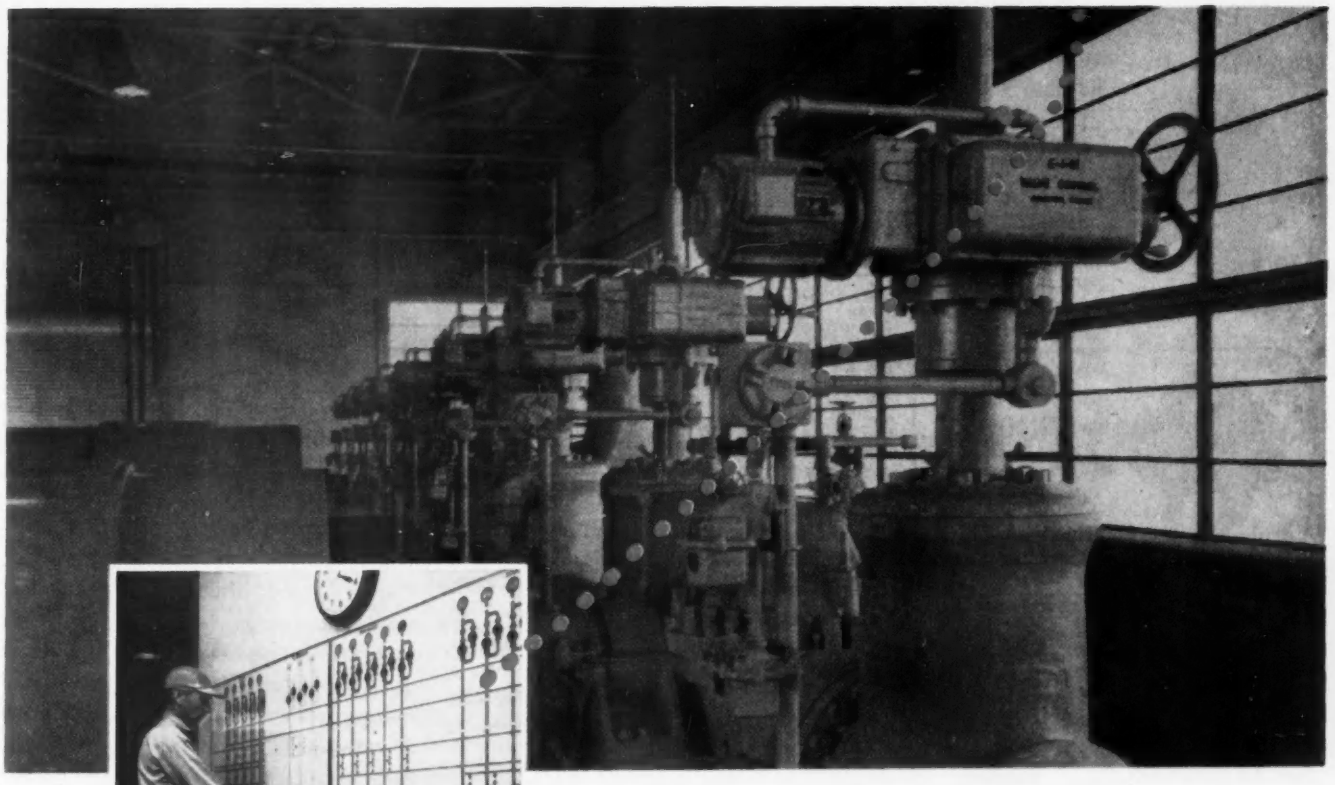
General Contractors

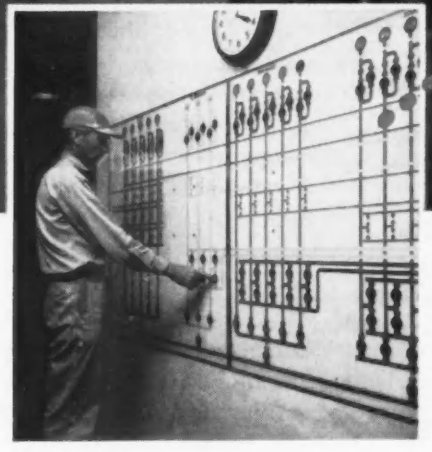
Oil - Gas - Gasoline - Water Pipe Lines

2707 FERNDALE HOUSTON 6, TEXAS

EFFICIENT, INSTANTANEOUS MOVEMENT

West Texas Gulf Pipe Line Co., like many outstanding transmission lines, makes E-I-M Valve Controls the heart of the modern pumping station—striking a single push-button automatically opens the station block-valve and in sequence the pump suction-valve, pump motor, pump discharge-valve





Progressive pipe liners specify E-I-M Valve Controls

E-I-M Company INCORPORATED

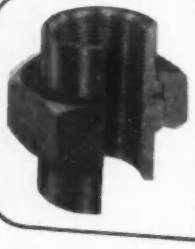
1340 OLD SPANISH TRAIL • HOUSTON 21, TEXAS • MOhawk 4587

Valve Controls • Speed Reducers • Cooling Tower Drives • Control Valves

Catawissa
PERFECT SEAL
Unions

HOT FORGED from solid, rectangular steel bars, designed and produced for dependable, long-life service under the severest piping conditions!

A TYPE FOR EVERY USE!
FOR ALL PRESSURES!
FOR ALL TEMPERATURES!



Standard & Double Extra Heavy
UNIONS
Available with screwed or socket weld ends. 3000-lb. sizes 1/8" to 3"; 6000-lb. sizes 1/8" to 2".

ORIFICE UNIONS
With screwed or socket weld ends. 3000-lb. and 6000-lb. service.

MALE & FEMALE UNIONS
With steel-to-steel, bronze-to-steel, stainless steel-to-steel or orifice seats. 3000-lb. service only.

Standard & Double Extra Heavy
LUG NUT UNIONS
Hammer-type for quick opening and quick closing.

write for your free copy of
CATALOG 11
for complete information
CATAWISSA VALVE AND FITTINGS COMPANY
60 Mill St. • CATAWISSA, PA.

Salt Lake Pipe Line Starts Construction Late This Month

Salt Lake Pipe Line Company, a Standard Oil Company of California subsidiary, expects construction to start late this month on its 135-mile 8-inch oil products pipe line from Pasco to Spokane. Completion is scheduled for October 1. Engineering and right-of-way work is proceeding on schedule. The line will follow a direct route from Pasco on the Columbia River to Spokane, going through areas adjacent to Sulphur, Pizzaro, Keystone and Waukon. The line enters the Spokane area west of the city and will terminate at Hillyard.

There will be only one pump station on the line, located at Pasco. There will be three motor-driven centrifugal pumps with a total of 700 horsepower. Capacity of the line will be 15,000 bpd, and the line will carry two grades of gasoline and several grades of heating oil. Cost of the project will total approximately $4 million.

Phillips Plans To Begin Construction Immediately

Phillips Pipe Line Company, wholly owned subsidiary of Phillips Petroleum Company, will begin construction immediately of a gathering system and main line to transport crude oil from the northeast area of Andrews County, West Texas, the scene of extensive development activity.

The new facilities will include 18 miles of gathering lines and 26 miles of 8-inch main line, through which the crude oil will be transported to Andrews Station on the company's trunk line system which carries West Texas oil to Borger and to Phillips Oklahoma-Kansas pipe line system.

Three Applications Combined With El Paso Natural Hearing

The applications of three California companies, Pacific Gas and Electric of San Francisco, Southern California Gas, and Southern Counties Gas, both of Los Angeles, have been combined with a proposal by El Paso Natural Gas Company on which a Federal Power Commission hearing was scheduled to start June 1.

The El Paso project, estimated to cost $179.7 million, would include 1792 miles of line and 161,860 horsepower in compressor capacity. These facilities would permit the delivery of an additional 300 million cubic feet per day from the Permian Basin in southeast New Mexico and West Texas, and an additional 100 mmcf daily from the San Juan Basin in northwest New Mexico and southwest Colorado. The additional gas would be delivered to customers in Texas, New Mexico, Arizona and California.

Pacific Gas proposes to build facilities estimated to cost $26.9 million to enable the transportation of additional gas proposed to be received from El Paso. The two Los Angeles companies would spend $7.5 million on their project.

Texas Illinois Natural Gas Gets FPC Okay on Increase

Texas Illinois Natural Gas Pipeline Company of Chicago has been authorized to increase the capacity of its natural gas transmission system from the presently planned 374 million cubic feet daily to a new total of 504 million.

Texas Illinois will construct six compressor stations, with a total capacity of 70,000 horsepower, and install a total of 10,000 additional horsepower at five existing stations. The company also will build five lateral pipe lines and one loop line with an aggregate length of 74 miles, extending from its existing main line to additional sources of gas supply. The additional supply will be secured from eight fields in south Texas—Chocolate Bayou, Fairbanks, East Bay City, West Bernard, Heyser, Hagist Ranch, Amargosa and Southeast Clayton.

The project also includes a suspension-type bridge supporting two 30-inch lines across the Mississippi River at approximately the point of the company's existing underwater river crossing near Grand Tower, Ill. Total estimated cost of the Texas Illinois project is $42.1 million, including $3.2 million for the river crossing.

Cities Service Gas Company Seeks Additional Facilities

Cities Service Gas Company of Oklahoma City has applied for authority to construct 69 miles of pipe line and to install an 1100-horsepower unit at the company's Edmond compressor station in Oklahoma County.

The proposed line, consisting of 44 miles of 20-inch and 25-miles of 16-inch, will be in Cleveland, McClain and Garvin counties, Oklahoma.

PIPE LINE PROGRESS

A. O. Smith Line Pipe being lowered in for a Southern Natural Gas Company Transmission Line.

Southern Natural Gas Company's new lines to tap south Louisiana gas fields

By year's end, Southern Natural Gas Company will have lowered in 311 new miles of 24-inch, 20-inch and 16-inch mains to bring Duck Lake, Main Pass and intermediate production to Gwinville, Mississippi. Here, south Louisiana gas will enter the company's east-west system for distribution to Mississippi, Alabama and Georgia consumers.

This new mileage, except for some field and gathering lines, will all be A. O. Smith line pipe, 68 miles of 24-inch from Gwinville to Franklinton, La., 220 miles of 20-inch comprising the legs to Duck Lake to the southwest and Olga to the southeast. 23 miles of 16-inch extend the Olga leg to Main Pass in the Gulf.

FIRSTS by A.O. Smith: Welded line pipe • Internally expanded pipe • Light-wall large-diameter pipe • World's largest producer of large-diameter welded steel pipe.

Unusual pipelining practices will be employed near the gulf, where much of the land is under water or close to it. Here the pipe will be lowered into canals. Concrete jacketing will be applied as a protective "ballast."

At completion, Southern Natural Gas Company's transmission system will contain more than 1,000 miles of A. O. Smith line pipe, including earlier shipments. Current requirements are being shipped from our Houston and Milwaukee mills in close harmony with the construction schedules.

A.O. Smith Line Pipe is available in a complete range of sizes and wall thicknesses, from 8⅝-in. to 36-in. diameters.

The A.O. Smith Casing Mill is operating at capacity to supply vitally needed casing for the Oil and Gas Industry.

A.O. Smith

CORPORATION

LINE PIPE • CASING

Chicago 4 • Dallas 2 • Denver 2 • Houston 2
Los Angeles 22 • Midland 5, Texas • New Orleans 12
New York 17 • Pittsburgh 19 • San Francisco 4
Seattle 1 • Tulsa 3 • Washington 6, D.C.

International Division: Milwaukee 1

DEPENDABILITY THROUGH RESEARCH AND ENGINEERING

Columbia Gas Subsidiaries Receive FPC Authorization

Eight subsidiaries of The Columbia Gas System, Inc. have been given authorization by the Federal Power Commission to carry out natural gas pipe line construction projects.

The applications which were granted were filed by Atlantic Seaboard Corporation, Virginia Gas Transmission Corporation, Central Kentucky Natural Gas Company, and United Fuel Gas Company, all of Charleston, W. Va.; The Manufacturers Light and Heat Company, Natural Gas Company of West Virginia, and Home Gas Company, all of Pittsburgh, Pa.; and The Ohio Fuel Gas Company, of Columbus, Ohio.

The FPC decision authorizes five applications by Ohio Fuel, involving a total of 116 miles of new pipe line costing $4.7 million. Manufacturers, which had filed a joint application with Natural Gas Company of West Virginia and Home Gas Company, was authorized to build 9.3 miles of pipe line and a measuring and regulator station, having a total cost of $348,700. Natural Gas Company of West Virginia received authorization for the construction of 21.3 miles of pipe line, having a total estimated cost of $840,000.

Estimated cost of Home Gas Company's facilities is $668,000. They will construct a total of 19 miles of pipe line in Chemung, Tioga and Broome counties, N. Y. United Fuel Gas will build 21.5 miles of pipe line in two gas storage fields in Wood and Upshur counties, W. Va., a new 880-horsepower compressor station and will install 3960 hp in an existing station near Charleston, W. Va. Total estimated cost of these projects is $2.4 million.

Atlantic Seaboard received authorization for two compressor stations in Pendleton and Hardy Counties, W. Va., with a total capacity of 7640 hp, at an estimated cost of $3.3 million. Central Kentucky was authorized to construct 8.8 miles of line looping an existing line from North Means, Ky., to Cincinnati.

The decision denies applications by Shenandoah Gas Company, of Lynchburgh, Va., and Rockland Light and Power Company, of Nyack, N. Y., which had requested the FPC to order Columbia subsidiaries to supply them with natural gas, and authority to construct proposed new pipe line facilities to transport this gas.

Service Pipe Line Company Electrifies Bowie Station

Electrification of Service Pipe Line Company's Bowie pump station is scheduled for completion by June 1, J. P. Bradley, Bowie district superintendent, has announced.

Service personnel have poured foundations for the new station, a modern installation that will have two 1000-horsepower electric units. The units will replace four diesel engines. The company will raze the old brick station building, a Bowie landmark since 1919.

Electrification of the station is another step in the company's modernization program, launched last summer.

Sixty-eight employes now are headquartered at Bowie. Service Pipe Line Company has maintained district offices at Bowie since 1931.

The company operates 12,456 miles of crude oil pipe lines in 11 states. An important point in the system, Bowie station is the junction for crude oil moved by lines from central and west Texas. Bowie pumps the oil to Oklahoma for eventual delivery to refineries throughout the Midwest.

Wilcox Trend Gathering Line Proceeds With Construction

Wilcox Trend Gathering System, Inc., of Dallas, Texas, has awarded a contract for pipe line construction to H. B. Zachry Company of San Antonio, Texas, according to an announcement by Harry W. Bass, president of Wilcox Trend. The contract includes the construction of 116.8 miles of 14- and 16-inch pipe line from Duval County, Texas, to DeWitt County, Texas, and the crossing of the Guadalupe River.

Altgelt Construction Company, Inc., of Corpus Christi, Texas, has been awarded the construction of approximately 85 miles of laterals and gathering lines. Brown & Root, Inc., Houston, was awarded the construction of a 2200-horsepower compressor station to be built near Thomaston, Texas. Construction is scheduled for completion this summer.

Texas Eastern Pays $9.6 Million For Gas Producing Properties

Texas Eastern Production Corporation is purchasing producing property from Meredith, Clegg and Hunt et al in the West Hampshire field of Jefferson County, Texas, for $9.6 million. Production of these properties is approximately 20 million cubic feet of gas per day.

The gas is being purchased by Texas Eastern Transmission Corporation and is processed by Texas Gas Corporation's gasoline plant near Winnie, Texas. The residue gas is delivered by Texas Gas Corporation to the 20-inch natural gas transmission line of Texas Eastern Transmission Corporation in the area of Texas Gas' Winnie plant.

Cities Service Increases Crude Transportation in 1952

The total volume of crude oil and refined oil products transported during 1952 through Cities Service pipe lines and pipe lines of associated companies amounted to 362 million barrels, an increase of eight percent over 1951.

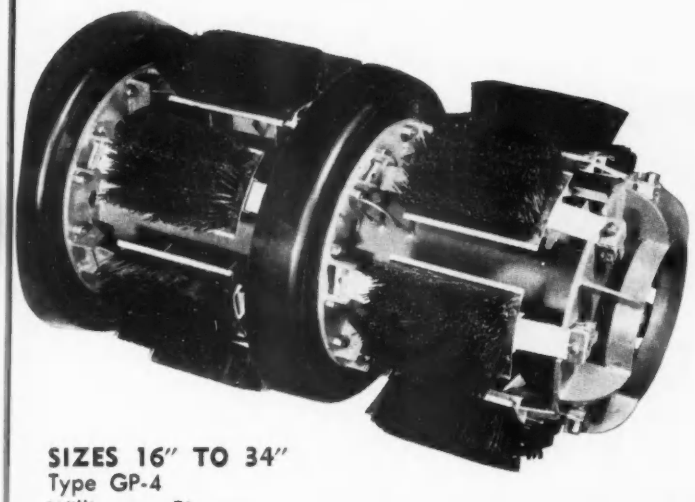
West Texas Gulf Pipe Line Company, in which a stock interest is owned, completed its large diameter pipe line from West Texas to Longview and Sour Lake, Texas, early in 1953. Mesa Pipe Line system, in which an undivided interest is owned, has completed a connecting pipe line from Midland, Texas, to the terminus of the West Texas Gulf line at Colorado City, Texas.

Cities Service subsidiary participated in the formation of Wolverine Pipe Line Company, which is constructing a products pipe line extending from Chicago to Detroit and Toledo. Initial capacity of the line, scheduled for completion late in 1953, will be 100,000 barrels daily.

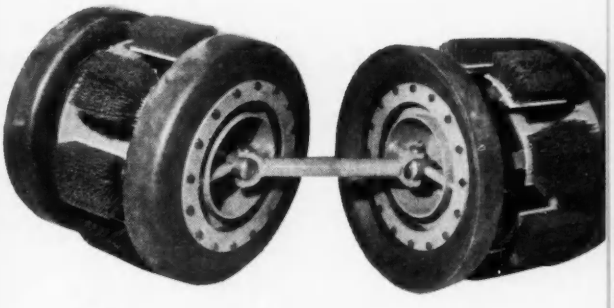
Increased Pipe Line Mileage Noted On Fifth Anniversary

Texas Gas Transmission Corporation, observing its fifth anniversary, was formed through the merger of two 20-year-old companies, Memphis Natural Gas Company and Kentucky Natural Gas Corporation. The two companies together had 1485 miles of pipe line and eight compressor stations with total horsepower of 29,115. Today, five years later, the company's pipe line mileage total has increased to approximately three thousand and its rated compressor horsepower, after the addition of 13 stations, is 140,080.

specific **PIG** *design for every pipe line condition*

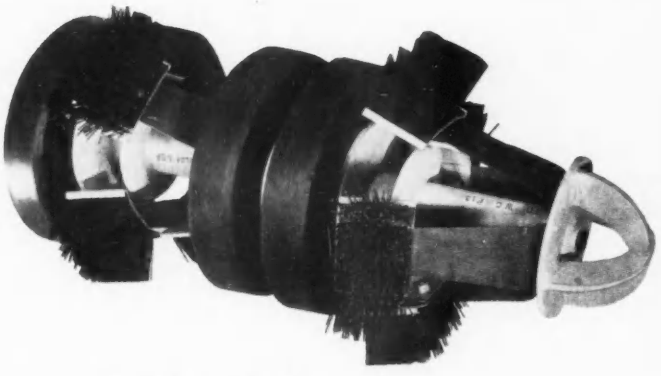


SIZES 16" TO 34"
Type GP-4
Williamson Pig

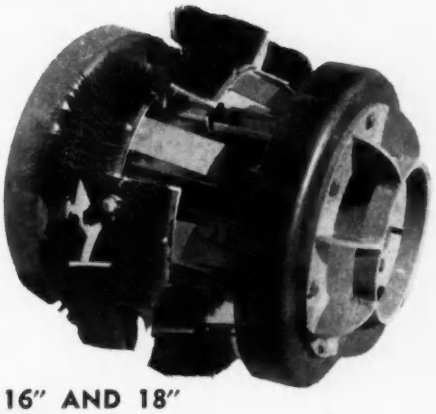


SIZES 20" TO 34"
FOR SHARP BENDS
Type GP-3
Williamson Pig

WEAR COMPENSATING



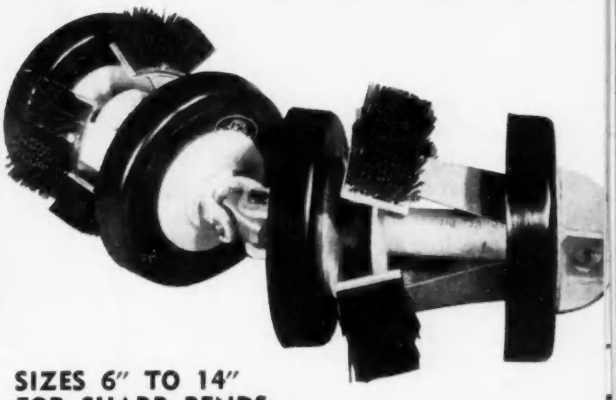
SIZES 6" TO 14"
Type WC-11 Pig (With Standard Springs)
Type WCK-11 Pig (Extra-Strong Springs)



SIZES 16" AND 18"
Type UG-1
Williamson Pig

Other Pig Designs Available for 5" pipe and smaller.

REPRESENTATIVES . . . HOUSTON • PITTSBURGH KENILWORTH, N.J. • AMARILLO • CASPER • PROVO, UTAH • LOS ANGELES • OAKLAND • EDMONTON • CALGARY • TORONTO • BUENOS AIRES • DURBAN, SOUTH AFRICA



SIZES 6" TO 14"
FOR SHARP BENDS
Type WC-3
Williamson Pig

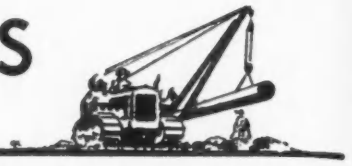
T. D. Williamson, Inc.

THE PIG WITH THE POKE
CLEANS PIPE LINES

P. O. BOX 4038
TULSA 9, OKLAHOMA

WRITE FOR DESCRIPTIVE FOLDERS

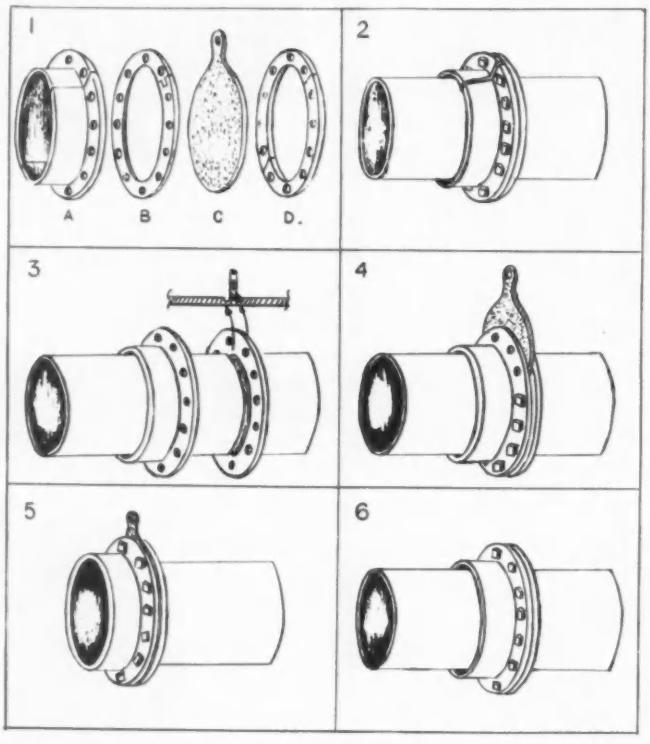
How to do it! PIPE LINE HINTS



$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

Cut Outs on Low Pressure Pipe Lines Made Safely

Make a safe job of blanking off low pressure large diameter gas lines by inserting a "frying pan" of steel plate between two flanges. The method is superior to the conventional bag and stopper technique according to H. T. Libby, superintendent, Gas Distribution, British Columbia Electric Co., Ltd., Vancouver, B. C. He described the new method to Pacific Coast Gas Association at a meeting in Los Angeles, February 18 and 19.



1. Cut the flanges in half so they can be slipped over the pipe and rewelded. Then cut a frying pan shaped steel plate of heavy enough gage to withstand the pressure of the line. Machine the edges so the plate can be slipped between the flanges without damaging the gasket.

2. Assemble the flanges on the pipe with cuts at right angles so each flange acts as a splint for the other. Line up flange D and weld it to the pipe in the normal way.

3. Slide the other flange down the pipe and groove the pipe as deeply as you dare with a cape chisel pneumatic gun. Make this groove about three-eighths-inch wide. Next cut the pipe with a pneumatic chisel, caulking the cut with rags as you go. Meanwhile, cement the gaskets to the face of the flanges.

4. Remove the rags, look through the cut to make sure that it is clear. Grease the frying pan and insert it. Bring up the companion flange and bolt it tight.

5. Purge the pipe between the frying pans and proceed with the cut out. No gas will be present and oxy-acetylene cutting may be used.

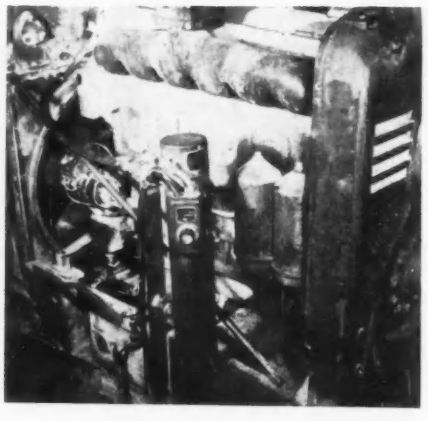
6. Then slip the new pipe into the flange and weld it. Remove the frying pan and re-bolt the flanges.

This same method can be used to advantage anytime that a line is being capped off to be extended at some future date.

Electricity Keeps Engines Warm

Diesel engines used in tractors, draglines and other equipment used outdoors can be kept ready to operate in the coldest weather safely and automatically with electric heat. A few kilowatt-hours of electricity can save many man and equipment hours ordinarily lost in waiting for engines to warm up.

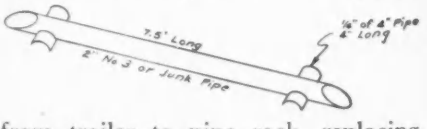
Attach a small electric heater to the engine block with angle iron. With flexible connections to the cooling system, regular types of antifreeze can circulate by natural convection through the heater and engine block,



warming the engine in a short time. Special pumps are not required. The photograph shows one of the heaters attached to a diesel engine.

Light Pipe Skids Prevent Slipping

Lightweight pipe skids that won't slip can be made inexpensively from two or three-inch pipe. They can be used for loading or unloading pipe



from trailer to pipe rack, replacing the usual wooden skids used for this service.

As shown in the drawing, the skids are cut about 7 or 8 feet long. Near each end saddle-in a quarter-section of 4-inch pipe. This serves as a grip. Miter the ends as shown.

Electric Weld LINE PIPE...

Electric Resistance Weld and Electric Fusion Weld

Whatever the size of the line you're building, it will go in with a minimum of delays and other difficulties if it's Republic Electric Weld Line Pipe. Everything from a small gathering line to the largest gas line can be specified "Republic"... to your benefit.

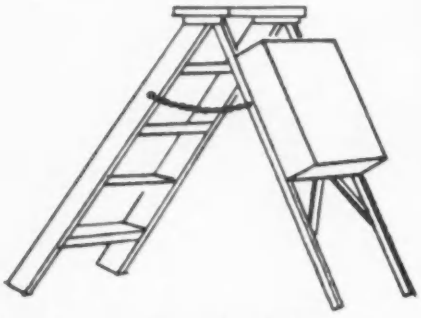
The way it's made makes Republic Line Pipe uniform . . . uniformly flat steel is formed into a tube, then electric-welded to produce a uniformly strong pipe. Walls are uniform in thickness to give your crews pipe ends that match-up right, that weld evenly and uniformly. The ductile, low-carbon steel will weld readily, too. High ductility assures smooth, uniform bends in the field or the shop.

Freedom from scale makes the outer surfaces easier to wrap and protect with fewer holidays. Freedom from inside scale prevents loosening of scale after blowing-out, protects instruments and valves from clogging.

More than 67,000 miles of Republic Electric Weld Line Pipe and 23 years of service for many of these miles help prove that your best investment for transmission, gathering, distribution, and product lines is Republic Electric Weld Line Pipe...either Electric Fusion Weld or Electric Resistance Weld. Literature on both types is available from:

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N.Y.

Republic REPUBLIC STEEL
ELECTRIC WELD LINE PIPE
Electric Resistance Weld and Electric Fusion Weld

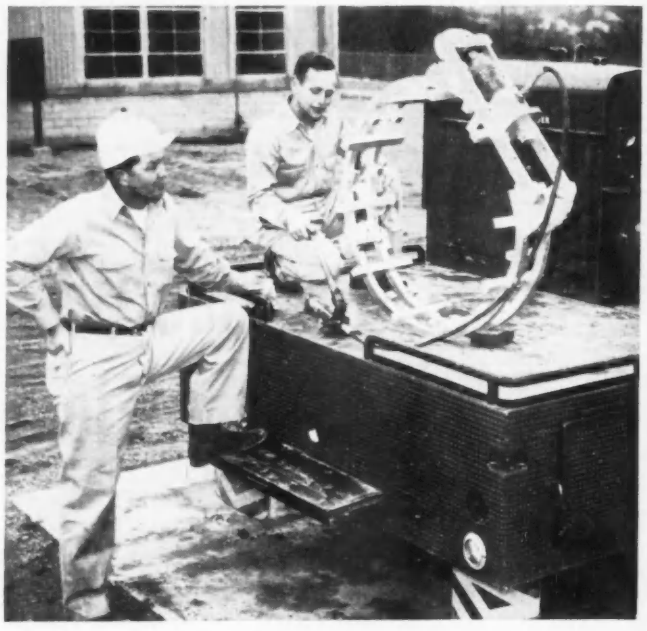


Box on Stepladder Aids Electricians

Attach a demountable plywood box to the back of a stepladder to simplify the electrical maintenance man's overhead work. The box provides a handy place for fluorescent light tubes, tools, wire and extension cords. The electrician will not have tools weighting down his pockets while he is working.

The size of the box will vary with use. In any case it should be as wide as the ladder so it can be clipped to the two back legs. Four clips screwed onto the back of the box are arranged so they will drop over the heads of screws in the legs. Thus the electrician can lift the box off the ladder and store it when it is not in use.

Hydraulic Clamp Aligns Casing



Make a line-up clamp for big-inch casing right in the shop. That's what men at Tennessee Gas Transmission Company's Compressor Station at Carrollton, Ohio, did. They replaced the lever on an ordinary external line up clamp with a hydraulic piston and came up with a clamp that will put a terrific squeeze on casings to line them up while the welder is making his tack welds.

Welder O. L. Stevenson and Utilityman W. E. Dehart, members of the crew that devised and fabricated the clamps, are shown in the photo.

Note the small high pressure tubing that is attached to the piston and to the hydraulic pump. A small needle valve on the pump enables workmen to hold the pipe in place while the welds are being made. The carriage for the hydraulic piston can be made in such a way that the piston can be used of different size clamps.

The Beaver 41-E Threader
. . . A Companion to
the Beaver 104 Pipe Cutter

both are quality tools—rugged—dependable—and low in upkeep cost

With one set of dies the fully adjustable 41-E Geared Threader threads 2½, 3, 3½ and 4-inch pipe, no dies to become lost or mislaid. Cuts oversize, undersize, standard taper pipe or straight conduit threads without changing dies.

1. Fully enclosed gears packed in graphite grease, protect important parts.
2. Gear case is made of tough semi-steel. Rugged in construction—low in upkeep cost.
3. Driving pinion's lower end rides in a bronze bushing greater strength—smoother performance.
4. For 35 years the most dependable 2½ to 4" threader made.

BEAVER PIPE CUTTER, No. 104—2½ to 4"—Automatic knife pipe cutter, for use either as a hand-operated or a power-driven tool. No loose parts. Fully enclosed. Only cutting head revolves, driving pinion remains stationary. Cuts pipe square without burrs. Rugged construction, economical operation.

You ought to know more about these tools. Write for general catalog.

BEAVER 41-E THREADER
Range 2-1/2 to 4"

BEAVER 104 PIPE CUTTER
Range 2-1/2 to 4

BEAVER PIPE TOOLS

254-300 DANA AVENUE WARREN, OHIO, U. S. A.

MULTIPLE OFFICES mean BETTER SERVICE

EXPERIENCE means BETTER PIPE LINES

NORTH AMERICA
EDMONTON
TORONTO
TULSA
MINNEAPOLIS
NEW YORK
LOUISVILLE
WASHINGTON
ATLANTA
HOUSTON
NEW ORLEANS

SOUTH AMERICA
CARACAS
MARACAIBO
BOGOTA
LA PAZ
RIO DE JANEIRO

MAIN OFFICE:
TULSA

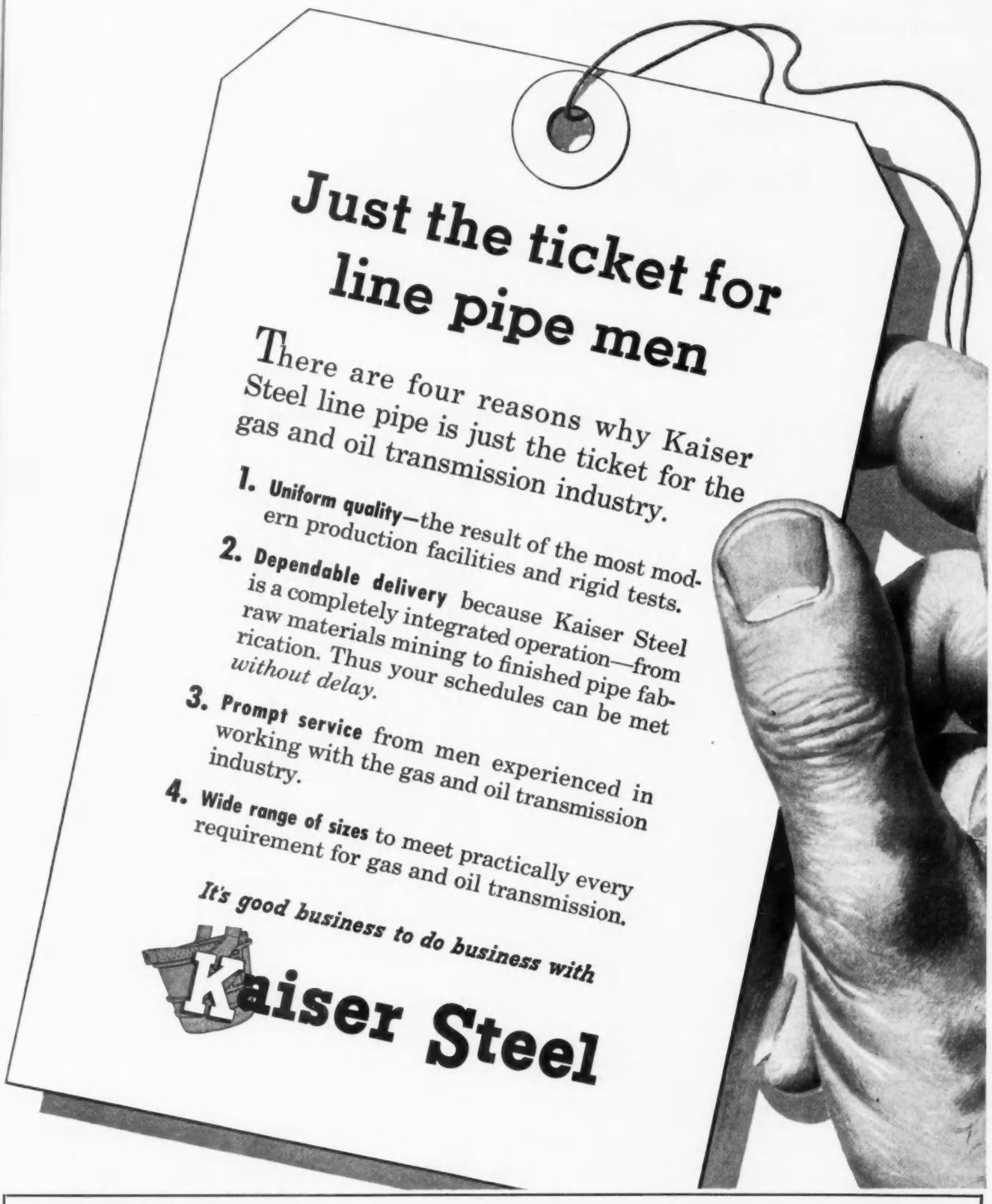
Pipelines are NOT sidelines with

WILLIAMS BROTHERS

ENGINEERS
CONTRACTORS

OIL • GAS • PRODUCTS • WATER
PIPELINES AND PUMPING STATIONS

Write your nearest Williams Brothers office


Just the ticket for line pipe men
There are four reasons why Kaiser Steel line pipe is just the ticket for the gas and oil transmission industry.
1. Uniform quality—the result of the most modern production facilities and rigid tests.
2. Dependable delivery because Kaiser Steel is a completely integrated operation—from raw materials mining to finished pipe fabrication. Thus your schedules can be met without delay.
3. Prompt service from men experienced in working with the gas and oil transmission industry.
4. Wide range of sizes to meet practically every requirement for gas and oil transmission.
It's good business to do business with
Kaiser Steel

KAISER STEEL PIPE SPECIFICATIONS • All pipe manufactured to latest A.S.T.M. and A.P.I. specifications

Type	Diameter	Length	Wall Thickness	Shipping Point
Continuous Weld—Threaded and Coupled	½" to 4" nominal I.D.	Uniform 21'	Standard	Fontana, Calif.
Continuous Weld—Plain End	2⅜" to 4½" O.D.	Up to 40'	Standard	Fontana, Calif.
Electric Resistance and Fusion Weld—Plain End	14" to 18" O.D.	Up to 40'	.250" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅝" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, Calif.
Electric Fusion Weld—Expanded—Plain End	20" to 30" O.D.	Up to 40'	.250" to .500"	Napa, Calif.—Basalt-Kaiser

Prompt, dependable delivery at competitive prices • KAISER STEEL CORPORATION Los Angeles, Oakland, Seattle, Portland, Houston, Tulsa, New York

Portable Shacks Are Economical

Save money on construction of pipe line pump or compressor stations by using portable shacks for offices and warehouses. The first cost is higher than that of a large combination warehouse and office building, but the salvage value is higher in case the buildings are to be retired. And, if the offices are to be moved to a new site, they can be loaded with tools and supplies and easily hauled on trucks or trailers.

Another advantage portable buildings have over permanent type ones is that they can be moved from place to place on an individual job. Many times it is advantageous to move the warehouses or offices about as construction progresses.

To be most effective, the portable shacks should be mounted on skids to make them easy to load or to drag about the job. They should be adequately braced to stand the jolts and rough handling they will receive.

FORMS

FOR FIELD AND OFFICE USE

- Labor Time Sheets
- Daily Time Records
- Truck Drivers' Reports
- Material Reports
- Pipe Tally Sheets
- Requisitions
- Emergency Orders

Write for Free Illustrated Catalog of Practical, Economical Forms Available From Stock for Immediate Shipment.

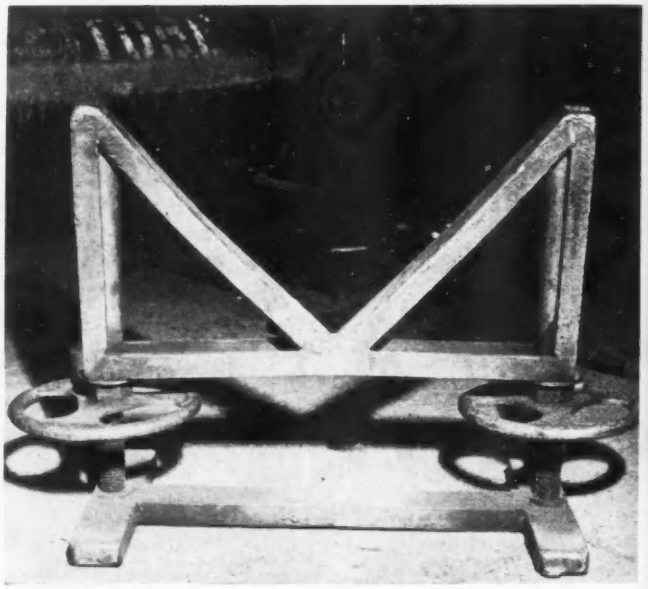
STOCK FORM DEPARTMENT

Gulf Publishing Co.

P. O. Box 2608

Houston 1, Texas

V-Block Speeds Pipe Fabrication



An adjustable V-block that speeds and simplifies pipe fabrication can be made easily in almost any pump station shop. The V framework is made of heavy section two-inch channel iron and braced with one-inch pipe. This pipe also forms a housing for the threaded section of the screw-jack made from alloy stud bolts and hex nuts. The bolts are one inch size.

The base of the device is of solid one-inch steel plate welded in an "H" shape. The two stud bolts are welded in an upright position to the base.

The handwheels are of five-eighths-inch steel rod welded to a hub of one-fourth-inch plate. The two hex nuts are centered inside the wheel. Note the two bearing plates made of oversized steel washers.

In the process of fabricating pipe, the handwheels permit minute adjustments of the pipe, and enables the fabricator to increase his accuracy. The total travel of the V-jack is nine inches.

GUNITE COATINGS FOR PIPELINES

One section of "GUNITE" coated 24 inch dual crossing at the Colorado River near Smithville, Texas. We did a similar job at the Brazos River. Reinforced "GUNITE" was placed over a mastic coating.

38 YEARS OF EXPERIENCE IN GUNITE CONSTRUCTION

- ENCASING
- LINING
- REPAIRING
- INSULATING
- FIREPROOFING
- REINFORCING

GUNITE CONCRETE & CONST. CO.

1301 WOODSWETHER RD., KANSAS CITY, MO

CHICAGO – ST. LOUIS – MINNEAPOLIS

DENVER – HOUSTON – NEW ORLEANS

Walkways Direct Pump Room Traffic

Paint walkways on the floor to control traffic in the pump room. People will automatically follow a marked path. And dark painted walks on the pump room floor will lead operators and visitors alike away from hazards of the room. In addition, it simplifies floor maintenance by concentrating the walking to specific areas.

Cuban Exploration Travels South

United States-Cuba Oil and Drilling Corporation will test promising Habana Province areas.

By DR. ALBERT RUSCHIL de la ROCHE

ALL PROVINCES of Cuba have seepages of oil and gas with the most important of these extending along the entire north coast. They have led to discovery of three producing fields in Cuba.

Among the most promising areas for future discoveries in Cuba is the south and central portion of Habana Province (see map, next two pages) in which area exploration was scheduled to be started in the spring by United States-Cuba Oil and Drilling Corporation (Cia E. U. Cuba de Petroleo y Perforacion, S. A.)

This area shows pronounced favorable structural conditions for the accumulation of oil. The area is most probably underlain by Jurassic and Lower Cretaceous, considered the source rocks for oil in Cuba.

The deposition of both sediments took place in deep water. They are of considerable thickness and of bituminous nature. Thick Upper Cretaceous and Tertiary sections form an impervious capping in the entire area to retain oil in the reservoir rocks. With the exception of the eastern portion of the Madruga anticline, petroliferous formations are not disturbed and conditions favorable to the accumulation of oil are present.

A series of parallel anticlines trending from east to west form favorable structures. The center part of the 87-mile long large Madruga Anticlinorium, as the Bejucal Dome, offers excellent possibilities and it is very probable that the Tobas (Tuffs), of Upper Cretaceous age, overlying the Aptychus (Lower Cretaceous) beds, will be of less thickness as they are in the region of San Antonio de los Banos where Ariguanabo 2 was drilled.

This well, drilled in 1939 by Cia. Petrolera Estrella de Cuba (Shell), was situated in the western part of the structure, about ten miles west of Bejucal, and near the region where the structure dies out. Drilled to a total depth of 10,035 feet, it started in marls and calcite veined marls Oligo-Miocene in age reaching the shales of the Midway or Lower Eocene at a depth of 2000 feet. This formation is exposed in the Bejucal Dome. The Copey 1, drilled by the same company in 1942 near San Antonio de las Vegas, encountered the same formation at 1400 feet. This well was situated on the south flank of the Bejucal Dome.

Structural Traps. Parralleling the Bejucal-Madruga anticlinorium, a large mild elongated anticline trends in east-west direction along the South Coast of Habana Province. There is a series of folds which might be considered structural traps. This structure extends, similarly to Madruga anticline, from the Province of Pinar del Rio to the Province of Matanzas.

The structure seems to be undisturbed volcanically and it is most probable that oil bearing formations underlie the entire area. This anticline has not been tested to date by any well. Real attention so far has only been paid to the northern part of the island, where most of the oil tar seeps were found. The southern coast has been completely neglected, just as the Insular shelf of the Gulf of Batabanó, where favorable structural conditions exist for the accumulation of oil. The region is most probably underlain by Jurassic and Cretaceous, and it appears most likely that oil will be produced from Tertiary and Upper Cretaceous horizons also.

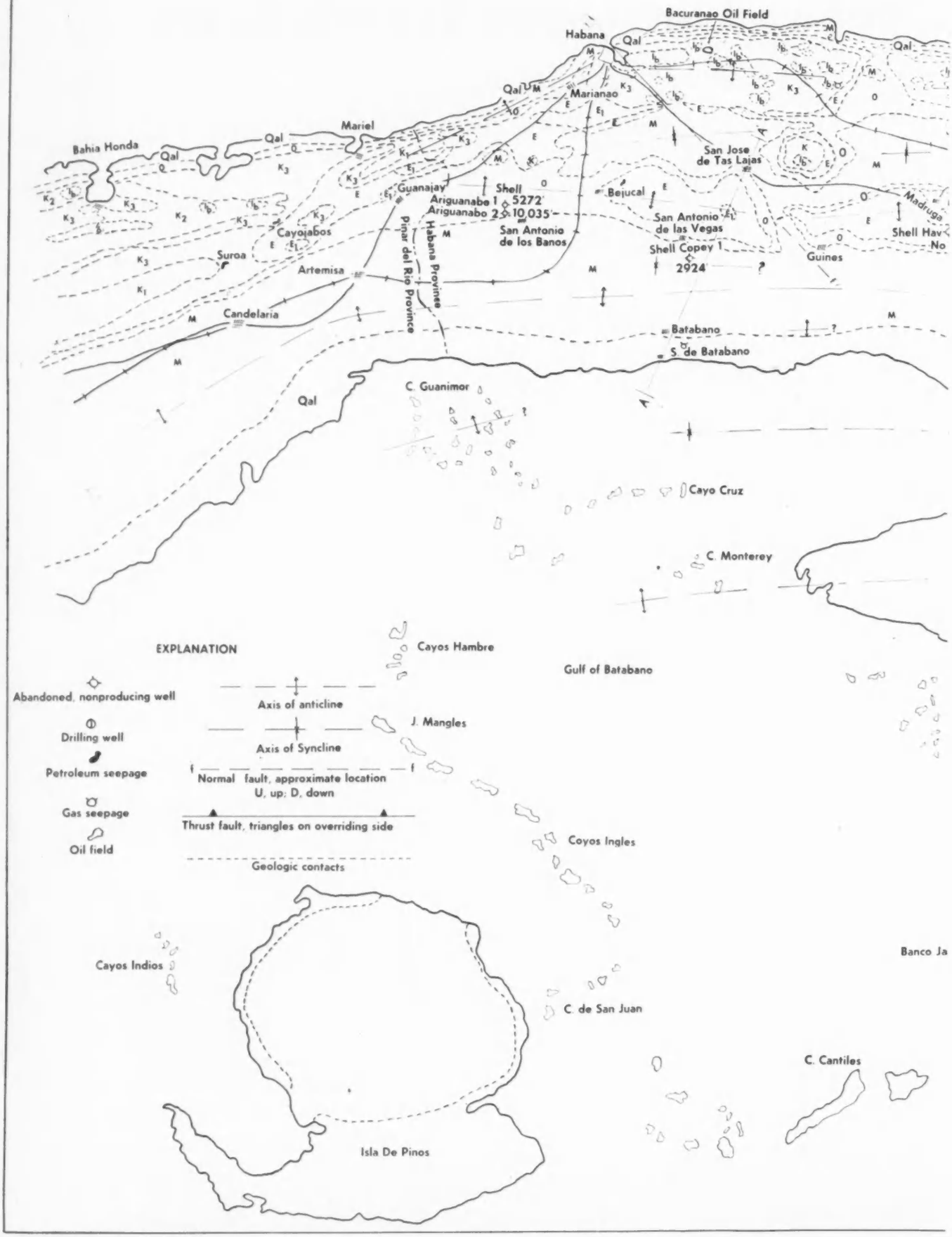
The geological column of Cuba ranges from Jurassic to Pleistocene. In its present form, Cuba dates from the late Miocene. In the Pleistocene, the island was larger, because at that time—and only then—the whole submerged southern part known as the Insular Shelf was above sea level. The Gulf of Batabanó represents a principal part of this shelf.

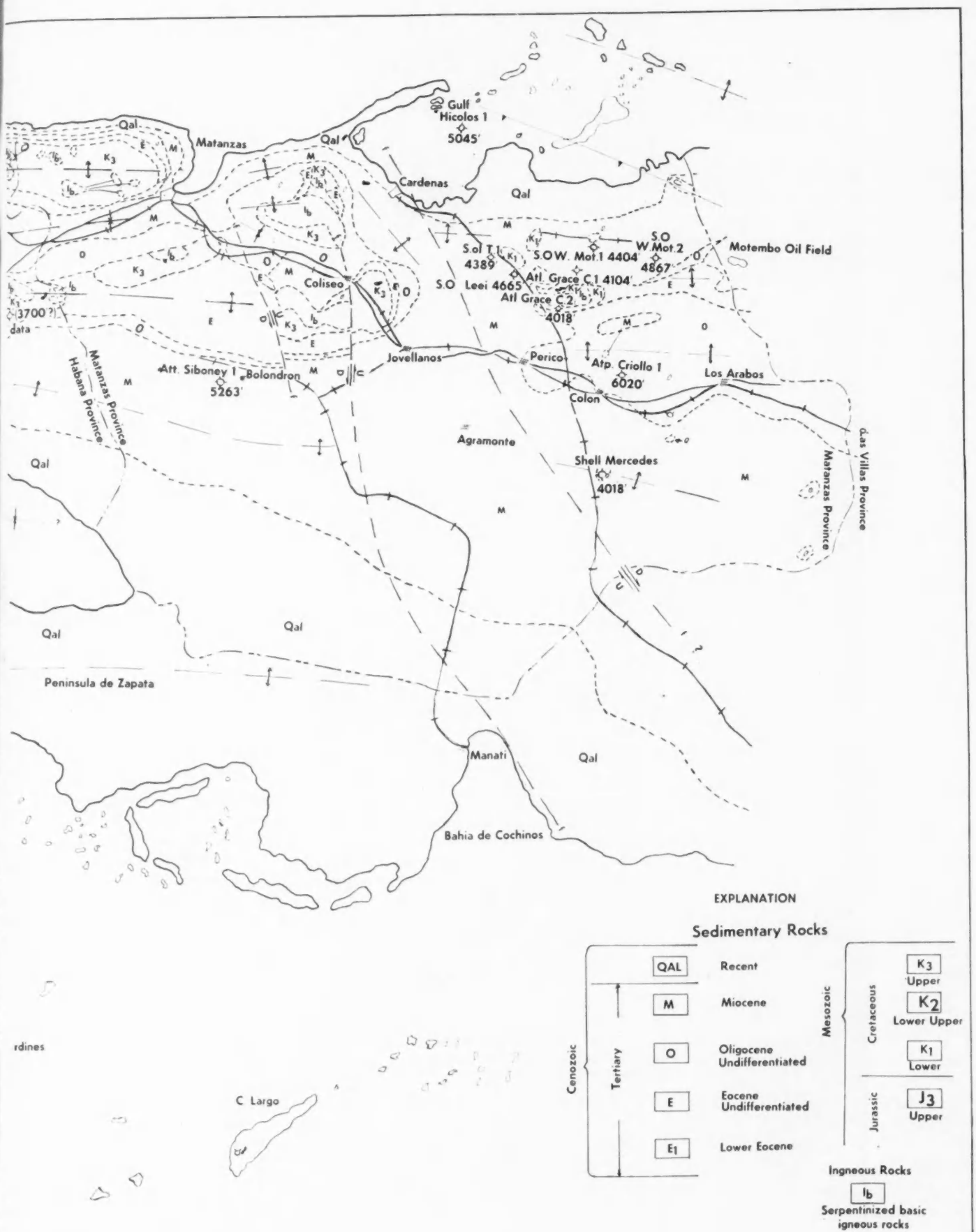
Between the Upper Jurassic and the Upper Cretaceous, the island was submerged and marine sediments were deposited, forming principally limestones, organic bearing formations, such as the Aptychus formations. The Aptychus beds, so called for the "Aptichi Opercula" they contain, are considered source beds of oil in Cuba. This formation, of a bituminous nature, probably originated in Upper Jurassic or Lower Cretaceous Age. Its equivalent in Mexico is called the Tamaulipas formation.

No wells drilled in Habana Province have reached this formation either for lack of suitable equipment or because they were not situated on favorable structures. The few wells drilled by independents to shallow depths with cable tool equipment could not reach the lower Cretaceous and were abandoned. Gas and good oil showings obtained in some of these wells indicated the presence of oil at greater depths; however, logs and core analyses were not carried out and nothing was reported officially.

In addition to the Aptychus beds, it is very probable that competent sands and reservoir rocks can be reached at comparatively shallow depths in the Tobas which promise

Geologic map of Cuba Pages 244-245 →


Bacuranao Oil Field
Habana
Qal
Marianao
Mariel
Bahia Honda
San Jose de Tas Lajas
Guanajay
Shell
Ariguanabo 1 ◇ 5272'
Ariguanabo 2 ◇ 10,035'
Bejucal
San Antonio de los Banos
San Antonio de las Vegas
Shell Copey 1
2924
Guines
Madruga
Shell Hav No
Cayojabos
Suroa
Artemisa
Pinar del Rio Province
Habana Province
Candelaria
Batabano
S. de Batabano
C. Guanimor
Cayo Cruz
C. Monterey
Cayos Hambre
Gulf of Batabano
J. Mangles
Coyos Ingles
Cayos Indios
C. de San Juan
C. Cantiles
Banco Ja
Isla De Pinos
EXPLANATION
Abandoned, nonproducing well
Drilling well
Petroleum seepage
Gas seepage
Oil field
Axis of anticline
Axis of Syncline
Normal fault, approximate location
U, up; D, down
Thrust fault, triangles on overriding side
Geologic contacts


Gulf Hicolos 1
5045'
Matanzas
Qal
Cardenas
Motembo Oil Field
S.O W. Mot.1 4404'
S.O W. Mot.2 4867'
Atl. Grace C.1 4104'
S.O Leei 4665'
Atl Grace C.2 4018'
S.ol T.1 4389'
Coliseo
3700 ?) data
Jovellanos
Perico
Atp. Criollo 1 6020'
Los Arabos
Colon
Att. Siboney 1
Bolondron
5263'
Habana Province
Matanzas Province
Agramonte
Shell Mercedes 4018'
Las Villas Province
Peninsula de Zapata
Manati
Bahia de Cochinos
C Largo
rdines
EXPLANATION
Sedimentary Rocks
QAL Recent
M Miocene
O Oligocene Undifferentiated
E Eocene Undifferentiated
E1 Lower Eocene
Cenozoic
Tertiary
Mesozoic
Cretaceous
K3 Upper
K2 Lower Upper
K1 Lower
Jurassic
J3 Upper
Ingneous Rocks
Ib Serpentinized basic igneous rocks

potential production of oil. The Tobas overlay the Aptychus and small quantities of oil have been obtained from fractures at depths varying from 3800 to 10,035 feet. This formation is considered to be an excellent impervious capping.

Important Structures. Three important structures, two of which have been mentioned briefly, extend across Habana Province. In the center part of the province, the large Madruga Anticlinorium extends eastward from the Province of Pinar de Rio into the Province of Matanzas, a distance of about 87 miles. This anticline is named for the town situated near the middle of the structure.

A dome with perfect closure is formed in the area of Bejucal-Managua-San Jose de las Lejas-San Antonio de las Vegas, which is the reservoir rock completely surrounded and capped by impervious rocks. Eocene is exposed in the entire dome with outcrops Lower Eocene in age in its eastern part. To the west, where the structure dies out, only the Oligocene is exposed. A large and wide Oligo-Miocene belt borders its northern, southern and eastern flanks. In the western part of the dome, some small faults have been observed with asphalt and oil seeps in the fractured zone.

In the area of Madruga lies the eastern portion of the large anticline. Its axis trends eastward into the Province of Matanzas. In the western half of this structure, Eocene is exposed and bordered by a wide Oligo-Miocene belt in the north, south and west showing a similar closure to the dome at the west. Along the axis of the anticline east of Madruga where colcanism, folding and erosion were more intense, Upper Cretaceous and Serpentine are exposed. Elsewhere, the Eocene forms the surface along the axis. No major faults have been observed within this structure.

The southern coastal anticline, which parallels Madruga Anticlinorium, has less intense folding with the result that the Lower Miocene or Oligo-Miocene form the surface everywhere along the axis. This structure extends midway between the Madruga anticline and the southern coast of the province. No major faults are known within the area of this structure, though some small fractures may exist, principally in the vicinity at Batabanó where a number of surface flows of gas and oil have been observed. The east end of this structure is cut north-south by a normal fault similar to the fault which cuts the Madruga anticline to the north.

The Zapata anticline extends from the Zapata Peninsula into the Insular Shelf of the Gulf of Batabanó. Its axis trends in east-west direction paralleling the southern coastal anticline. This area is a submerged part of the Cuban mainland which was only in the Pleistocene above sea level.

The sedimentary conditions are undoubtedly favorable and form identical marine deposits as the south coast of the Province of Habana and the Zapata Peninsula. Below the Quarternary, all the Tertiary and Mesozoic sediments are identical to those present to the east, west and north of this area. No major faults have been detected within this structure, but it is probable some faulting took place in the Gulf of Batabanó. Oil and gas seeps have been observed in the keys near to Batabanó.

Discovery Field. The first oil field discovered in Cuba was the Motembo field in the northwest section of Las Villas Province, which dates back to 1881. Records of production extend back only to 1934, and from that time through 1950 the field had produced about 1.5 million barrels of 61-65 gravity distillate. Approximately 1500 wells have been drilled in the field to depths ranging from 600 to 2200 feet.

The Bacuranao field, discovered in 1914, is some 12 miles east of Habana in Habana Province. About 70 wells have been drilled and oil is produced from the contacts of Serpentines and Upper Cretaceous limestones, at depths of 300 to 2000 feet. The field has produced a total of about 150,000 barrels of crude since 1915.

The Jarahueca field in Las Villas Province was discovered in October, 1943. About 100 wells have been drilled and completed at depths ranging from 750 to 2200 feet. Present production of 38-gravity crude amounts to about 200 barrels daily from 18 to 20 wells in the field. Production is from the tectonic contact between Lower Cretaceous limestones and Serpentines.

About the Author

DR. ALBERT RUSCHIL DE LA ROCHE is a consulting geologist and geophysicist, presently making his office in Havana. Prior to the communist capture of Czechoslovakia, Dr. Ruschil was chief geophysicist of the State Mines & Oil Fields and was a professor at the Prague Geological Institute. He is a graduate of the University of Prague and the University of Budapest and holds doctorates in geology, physics, chemistry and mathematics.

The International Operations Issue

WORLD OIL'S annual International Operations Issue will be published this year on August 15. For the first time, this special issue presenting complete oil and gas industry statistics on oil operations throughout the world will contain detailed reports on the U. S. oil and gas industry. Heretofore, the U. S. data was published in detail only in the Mid-Year Outlook issue August 15.

In addition, the International Operations Issue will contain:

- **Colored insert map of oil and gas operations and installations in South America.**
- **Black and white maps of all other oil-producing countries.**
- **Interesting, large-sized pictures of oil operations abroad.**
- **Country - by - country summaries containing complete data on countrywide oil and gas operations, economics, politics.**
- **World summaries of supply and demand, imports, pipe lines, refineries.**

1926 A gusher in the early Osage boom days.

Photo courtesy Griggs Studio, Bartlesville, Okla.

Osage County, Okla.

After the boom of the 20's came hard times. Now these Indians may strike it rich again.

By CLARENCE F. MANTOOTH
Associate Oil Editor, Tulsa World

CASH REGISTERS are jingling at a faster tempo in the land of the Osage Indians in Oklahoma. Thanks to secondary recovery operations by water flooding, the Osages are receiving larger headright payments from oil royalty.

Once "the richest people in the world," they may again see their income and their standard of living—lowered during days of declining production and worldwide depression—regain a semblance of the lush heydays of the 1920's.

Long prior to 1808 the Osage Nation of Indians, then known as the Great and Little Osages, occupied vast tracts of territory in the Province of Louisiana, then belonging to Spain. In 1800 Spain ceded the lands to France which by treaty in 1803 conveyed them to the U. S.

By a series of treaties throughout the early part of the 19th century, boundaries for the Osages were set by the U. S. government. The Osages in 1865 ceded their Kansas territory to the U. S. for $300,000.

The federal government put the Osages upon a small fraction of their original range. The tribe settled in 1872 on their new reservation which is now Osage County, Oklahoma. The land was hilly, the soil thin and poor. The Osages lived a hand-to-mouth existence. Small government annuities and moneys derived from leasing their lands to cattlemen for grazing purposes were their main sources of income.

But beneath that barren, desolate and apparently valueless land lay some of the richest oil deposits in the world. Less than half a century later drills were to determine the future of the Osages for decades to come.

Edwin B. Foster and Henry Foster, brothers from Rhode Island, came to Kansas. They became interested in an oil lease covering the entire Osage

1951 Members of Osage Tribal Council look on as George Labadie (center), a member of the council, turns the valve opening North Burbank water-flood unit on June 12, 1951. This unit is now the largest single water-flood project in world and will revive the waning fortunes of the Osage Nation.

Photo courtesy Phillips Petroleum Company

Photo courtesy Griggs Studio

The Carter Oil Company Nine Camp in Burbank field of Osage County as it appeared in 1926.

County, and on March 16, 1896, a lease was signed by James Bigheart, principal chief of the Osage tribe. The Fosters had the exclusive right to drill for oil throughout the Osage reservation after the lease was approved by the Secretary of the Interior.

On October 18, 1897, oil was discovered in the Osage Nation. During the next 50 years, tribal members received more than $285 million from oil and gas royalties, lease bonuses and rentals. But considerable history was to be written before the full significance of what lay beneath the Osages' rolling hills was to be determined.

Oklahoma's territorial governor in 1897 reported two test wells were drilled near Pawhuska, capital city of the Osages, and produced high grade oil. The next year he reported a well was immediately sealed after striking oil, adding that the drillers said the yield was too small to make it pay. He added that the company that put down the well afterwards leased large tracts of land in the Osage reservation.

Phoenix Oil Company and Osage Oil Company were organized. Later, on Dec. 10, 1901, the Indian Territory Illuminating Oil Company, a subsidiary of the Cities Service Oil Company, was organized to acquire leases and property of the Phoenix and Osage companies. The ITIO subleased rights to companies and drilling contractors and drilling proceeded.

Oil discoveries at Avant, Osage City, Okesa, and Wise in 1904 and 1905, and at Bird Creek in 1906 resulted in bringing royalty money into the Osage tribal treasury. Oil was found at Skiatook in 1911, and the mounting royalties became an important factor in Osage economy.

The Interior Department made a census of the Osage Nation in 1906, which showed 2229 members of the Osage tribe were entitled to equal shares in the tribal lands and profits from those lands. To each tribal member was assigned what was known as a "headright."

Interest Mounts. As new oil field discoveries continued, interest of oil men mounted. When proof of the existence of oil added value to Osage lands, lessees were required to submit sealed bids for leases.

The Osages held the first public auction sale of tribal lands at Pawhuska on Nov. 11, 1912. The Osage agency conducted the 100th auction of oil leases this spring in the auditorium at Pawhuska.

Auctions were first held in a small theater at Pawhuska, but were soon moved outdoors on the grounds of the Indian agency. Sales were conducted underneath a tree which was to become known as "the million dollar tree" because of the huge deals for leases made there.

At the first sale, Colonel E. Walters, official auctioneer for the tribe, disposed of 107,000 acres for a bonus of $39,000. Later, he became known as the famous auctioneer of oil leases, with a record of having sold millions of dollars worth of oil properties in a day.

W. H. Peck, oil editor of the Tulsa Daily World, wrote on Nov. 12, 1912, following the first Osage lease auction:

"A fair sized crowd of oil men were at Pawhuska yesterday to attend the sale of the Osage lands and the sale appears to have been a very successful one in spite of a long drawn out fight against it. It was conducted by James A. Carroll, superintendent of the Indian agency . . ."

Peck wrote that the Gypsy Oil Company bid $151.75 an acre for a 200-acre subdivision which "adjoins the Boston farm in section 1-21-7, on which the Gypsy . . . recently completed a good well." He added:

"It will not be known until today what action the Osage council will take in the matter, but it is supposed they will ratify the bids as they are far in excess of what has heretofore been offered."

Wildhorse, Hickory Creek, Barnsdall, Hominy and other oil reserves were tapped before the famed Burbank pool gave the Osages the fabulous wealth and made them the richest people in the world.

Discoveries prior to 1918 were in the eastern half of the Osage nation. The region west of Range 8 was first opened for public leasing at Pawhuska on Dec. 9, 1918, after nine auctions had already been held, taking in bonuses totaling $13,195,574.36.

The Carter Oil Company in 1919 moved the first tools in what is now the Burbank oil field. A test in Section 9-26n-6e, brought in a small gas well. But it was on May 8, 1920, that the Marland Oil Company brought in a 150-barrel producer on the Bertha Hickman farm, in SE NE 36-27n-5e, at 2949-3001 feet in the Bartlesville sand.

Biggest Gusher. Later in 1920, National Exploration Company, which later became Roxana Petroleum Company, now a part of Shell Oil Com-

The Twins can handle ALL your Bridging Plug Jobs!

What are your needs?

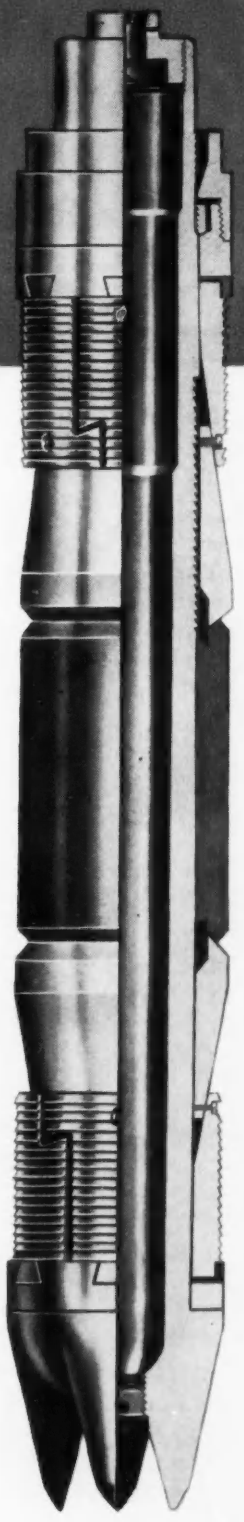
POSITIVE SETTING? The set position view, lower right, shows how the broad, opposed slips set the plug right where you want it — and *hold* it there against pressures either up or down.

LEAK-PROOF PACKOFF? Notice, in the set view, how the extra-large packing element, confined top and bottom against "flow" in either direction, gives permanent packoff.

HIGH PRESSURE RESISTANCE? Cast iron Lane-Wells Bridging Plugs have performed successfully against pressures up to 10,000 p.s.i. — magnesium Lane-Wells Plugs are rated up to 6,000 p.s.i.

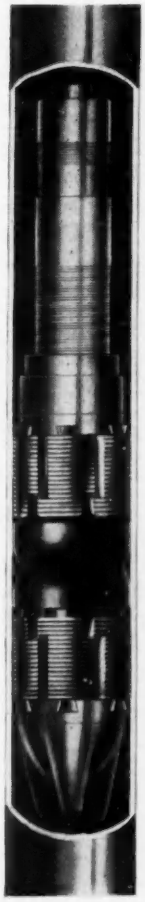
FAST DRILL OUT? Both cast iron and magnesium models are drilled out or knocked down in quick time, with either rotary or cable tools . . . magnesium in 1 to 3 hours, cast iron in 4 to 6 hours.

PERMANENCE? Lane-Wells cast iron Bridging Plugs will outlast the casing in permanent installations such as false bottoms or abandonments.



LEFT: This cutaway view shows the simple, sturdy construction of all Lane-Wells Drillable Bridging Plugs.

BELOW: This view of a Lane-Wells Bridging Plug in set position shows how it gives positive setting and leak-proof packoff.



LANE WELLS COMPANY

Drillable Bridging Plugs

Tomorrow's Tools-Today!

General Offices, Export Office, Plant • 5610 So. Soto St., Los Angeles 58

LOS ANGELES • HOUSTON • OKLAHOMA CITY • LANE-WELLS CANADIAN CO. IN CANADA • PETRO-TECH SERVICE CO. IN VENEZUELA

AU-6

The late Col. E. Walters standing beneath the famous elm tree in front of the Osage Indian Agency building where millions of dollars in lease money was paid by operators during early boom days in the Osage. The tree became known as the "million dollar tree" and Colonel Walters and his "striped candy" shirt became a legend among Mid-Continent oil men.

pany, brought in the biggest gusher in SE SW 4-26n-6e. It made 3450 barrels of oil the first 24 hours.

Burbank was drilled methodically, primarily by large companies. Carter's and Marland's production proved to be in the same field, and the major trend of development was to the north. Phillips Petroleum Company, W. G. Skelly, Waite Phillips, Gypsy Oil Company, Sinclair Oil & Gas Company, Prairie Oil and Gas Company, and Cosden Oil and Gas Company were among the major operators.

Wells were produced under wide open production methods, flowing, swabbing and pumping the wells to capacity. There was little knowledge of present day practices that would conserve gas for pressure maintenance.

The Burbank field expanded rapidly. By September, 1921, The Carter Oil Company was operating 23 of the 63 wells and produced 5445 barrels of oil a day of the total 22,570 barrels daily. In 1922 the field production rose to 75,000 barrels daily. Peak production was reached in July 1, 1923, with a daily output of 121,700 barrels from the field which covered 132 quarter sections or 33 square miles.

In four auction sales, from March 5, 1919, to Feb. 3, 1920, each Osage received $7,707.34 as cash bonus in addition to his share of one-sixth royalty on all oil produced and three cents per 1000 cubic feet of gas at the well. With a daily Osage area output of 45,000 barrels of oil and 500 Mmcf cubic feet of gas, the total oil and gas royalty paid each Osage tribesman was $3635. In 1919 it was about $7000.

At an auction sale on Feb. 3, 1920, the Osage tribe presented Colonel Walters, the auctioneer, with a diamond ring. The gift was for getting so much money for the Osages from lease bonuses. He was credited with adding millions of dollars to the Osage tribal funds by his appeals.

Phillips Petroleum Company and associates were the largest buyers at this auction, purchasing seven 160-acre tracts for $495,000 and paying $222,000 for a single tract. The total sale of 29,533 acres brought $3,102,700.

After May, 1920, when Burbank's discovery well blew in, 13 Osage land auctions were held at Pawhuska up to and including that of March 28, 1927, disposing of 532,876.75 acres. Huge prices were paid and proceeds continued to pour into the Osage coffers. Midland Oil Company gave $1,990,000 for a 160-acre lease at one sale.

One of the biggest lease auctions held at Pawhuska was that of Dec. 12, 1921. The Tulsa Daily World carried a front page streamer on the sale, along with this story:

"Yesterday's Osage land sale at Pawhuska will certainly go down in history as the greatest ever held since oil was discovered for the reason that practically all past records were smashed. The grand total of $7,267,600 surpassed all previous lease sales by more than a million dollars . . .

"The Prairie Oil & Gas Company led all others with a bid of $800,000 for tract 34, which is the southeast of 32-27-6, and is as a prospect, one of the best undeveloped leases in the entire Osage. The same company paid $700,000 for tract 31, which is the northeast of 30-27-6, and is probably equally as good as the higher priced acreage in section 34.

"Not only did the Prairie show its faith in the future, but other concerns like the Sinclair Consolidated, paid the enormous sum of $650,000 for No. 30, which is the southwest quarter of 29-27-6, and the bid was made by Harry Sinclair himself, who knows the oil game as it is played in Oklahoma.

"J. S. Cosden . . . paid $560,000 for No. 25, which is the northeast of 17-26-6, and $300,000 for No. 21, which is the northeast of 7-26-6."

The story also pointed out that Kewanee Oil Company paid $205,000 for a tract and Waite Phillips bid $115,000 for another quarter section.

Rags to Riches. This acquisition of riches plunged the Osages from one extreme to the other. From virtual poverty they attained the highest per capita income of any comparable group of people in the world. They traded their blanket rolls for bank rolls.

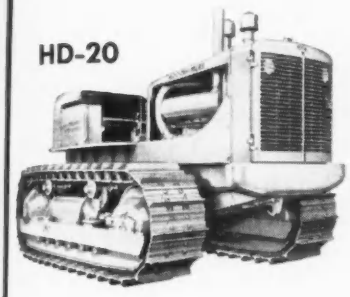
Some lived conservatively and invested wisely. But a majority spent lavishly. They bought many luxuries. Some Osages bought Cadillacs and Pierce-Arrows and then abandoned them beside the road if a tire blew out. One Indian, who liked to recline while riding, bought a shiny black hearse.

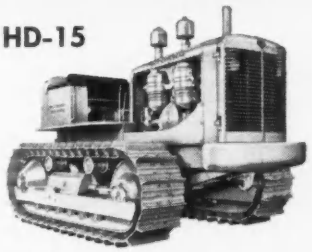
A blanketed brave and squaw reportedly appeared in an Oklahoma store, bought $18 worth of spring strawberries, squatted on the sidewalk and consumed the lot.

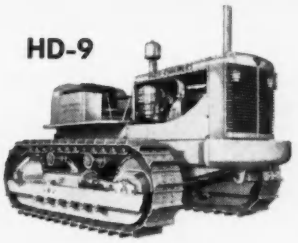
By 1923 Osage oil production reached 41,810,178 barrels. In one year alone—in 1925—the annual Osage headright payment was $13,200.

Murder, violence and unhappiness ran riot on the Osage reservation at the peak of their wealth. The Osage Nation became a land of mysterious events and sudden death.

In 1922 a series of deaths started with Anna Brown of Gray Horse. She was found dead in a lone canyon







There's more to tractors than meets the eye...

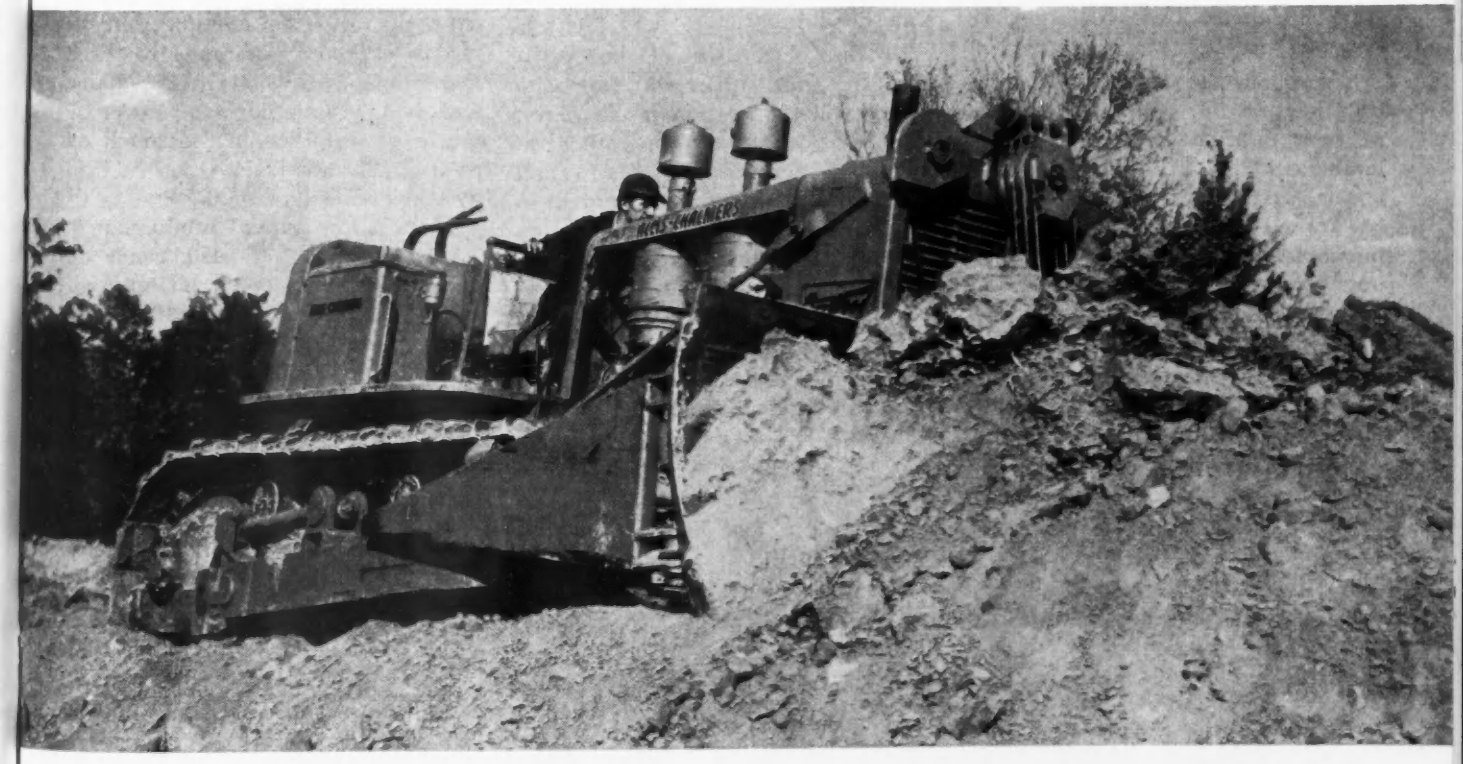
This 72 drawbar hp., 18,800-lb. HD-9 is an all-round oil field workhorse and, equipped with the 9X dozer, it's an outstanding performer on slush pit digging. Operators can gain up to 25 percent more production on short dozing jobs because they can go from any forward to any reverse speed with just one shift.

THE real "pay-off" value of any tractor to its owner is how it measures up to the standards set by today's modern production methods.

To meet these needs, Allis-Chalmers started from scratch and built *a line of tractors with a future.* Thousands now have been tested and proved on the toughest proving ground of them all, actual jobs, and they have more than measured up to expectations. Owners have found that these tractors set new standards of performance . . . that they give greater output with less down time . . . plus more profit, whether pulling, pushing, digging or dozing. Operators have discovered new ease and comfort in operation, too; and mechanics say these are the easiest-to-service tractors that they have ever worked on.

Yes, the "family circle" of users of Allis-Chalmers tractors is growing constantly. Many users who bought their first Allis-Chalmers tractor only a few years ago now have fleets of them, and many others who operate only one or two tractors have become Allis-Chalmers boosters.

This acceptance is the springboard behind a big plant expansion at Springfield, Illinois, which will enable Allis-Chalmers to meet *your* future needs. See your nearby Allis-Chalmers dealer now for the inside facts on pace-setting tractors that measure up to modern production methods.



Clearing drill sites, building access roads, hauling heavy drill rigs — wherever the jobs are big and tough, this big HD-15 has more than proved its worth. With 109 drawbar hp. and 27,850 lb. weight, it works quickly, efficiently with dozer, winch, tractor-shovel and sideboom.

ALLIS-CHALMERS

TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

on Three-Mile creek with a bullet hole through her head. Other deaths followed. Brutal methods were used to send these people to their happy hunting grounds. It was almost impossible to get witnesses to testify.

By 1929, oil operators had paid a total cumulative bonus for Burbank tracts of $63,784,300, for a bonus acreage average of some $2745.

By 1933, C. E. Murphy, superintendent of the Osage agency at that time, reported that the Osages had been paid $243,137,214.25 from oil from 1901 to June 30, 1932.

The agency reported in March, 1937, that the Osages had received $152 million for oil leases since the first auction in 1912.

As the oil played out, the Osage payments dwindled from thousands to hundreds of dollars. In the method of the oil industry of that day the wells were drilled for the purpose of getting high potential, following the practice of open flow. After passing its peak the Burbank field, in typical fashion, declined rapidly as the result of open flow method of production.

Income from oil lands dropped from $12,862,335 in 1928 to $1,716,330 in 1931. The richest people in the world faced an uncertain future by 1932. Income from oil was rapidly disappearing. Few of them saved any money, as money that came easy went the same way. Annual headright payments to the Osages dropped to only $585 in 1932.

Gas repressuring methods, to force the flow of oil after conventional methods failed, were begun on a limited scale in 1926. These did not become important until 1935 when gas from outside was purchased for injection into the North Burbank unit comprised of 23,240 acres, 18,580 of which was considered potentially productive.

During the next 16 years, more than 17,000 Mmcf of natural gas was purchased for injection into the reservoir. This operation has been successful and has resulted in the increased recovery of approximately 17.5 million barrels of oil.

By January, 1949, some 14,000 oil wells had been drilled in Osage county, and at that time about half were still producing, averaging 2.57 barrels of oil per day, and 2700 of them averaging less than one barrel per day.

Photo courtesy Griggs Studio

Chief Bacon Rind of the Osage Nation and Col. E. Walters after the former had presented the colonel with a diamond ring expressing the appreciation of the Osage Indians for the auctioneer's services in auctioning off tribal leases.

Water-flooding Begun. Negotiations by Phillips Petroleum Company and associates were started in 1946 among lessees to consolidate the separate leaseholds in the field into a unit for the purpose of starting an orderly waterflood program.

Because of the size of the operation, the unit lessees commenced a 90-acre pilot operation in February, 1950, in order to get operating information necessary to design and carry out the program required to waterflood a field of 18,850 acres. The present plan is to add 1000 acres yearly to the waterflood operation.

Osage county production, according to the Indian agency, had declined until only 7,121,111 barrels were produced in 1950.

But first response to waterflooding in September, 1950, brought hopes of the Osages up after 1.2 million barrels of water had been injected at the pilot operation. Production from 90 acres was raised from 37 barrels of oil per day to a peak of 989 barrels in January, 1951.

The pilot area was extended gradually, and on Nov. 1, 1952, approximately 1,501,178 barrels of oil had been recovered as a result of waterflood operations on a 1090-acre tract. The present rate of production is around 4100 barrels per day.

The North Burbank unit is the world's largest secondary recovery project by waterflooding. By June, 1951, there were 17 approved waterflood operations in the Osage covering some 60,000 acres, according to T. B. Hall, superintendent of the Osage Indian agency.

That part of Burbank field in Osage county had produced 170 million barrels of oil to the end of 1950, and under waterflood it is expected to recover 140 million to 150 million barrels. The project is operated by Phillips Petroleum Company, which owns a 50.81 per cent interest.

Obviously, large volumes of water are needed for such a project, particularly since adjacent fields, the Stanley Stringer and South Burbank fields, also eventually will be waterflooded.

A seven-mile 30-inch water line from the Arkansas river to the center of the North Burbank field was completed. Two smaller lines extend into other sectors of the field, with an estimated peak delivery of 300,000 barrels of water per day—enough to meet normal requirements of a city of 75,000 population.

Approximately 18 to 20 years will be required to complete development of the entire Burbank field, and an additional ten years to complete the entire operation. Production from the field is expected eventually to reach approximately 20,000 barrels daily, and the operators hope to recover by means of waterflooding as much oil as originally was taken from the field by conventional methods.

From a low annual production of 7,121,111 barrels in 1950, crude oil output in Osage county hit approximately 8,136,223 barrels in 1952. And from a low annual headright payment to the Osages of $585 in 1932, the present annual headright payment is approximately $1900.

The Osage Indians are looking forward again to substantial royalty payments, and the operators point out that by supplementing the forces of nature through the injection of water, a great conservation step is being achieved.

ACKNOWLEDGMENT

The author wishes to express his thanks to Phillips Petroleum Company, Cities Service Oil Company, The Carter Oil Company, Continental Oil Company., Osage Indian Agency, Pawhuska, and numerous individuals who furnished information and pictures for this article.

you have BAKER packers and bridge plugs set on a wire line

by your choice of these service organizations...

BJ SERVICE, INC. • DOWELL INCORPORATED • LANE-WELLS COMPANY • McCULLOUGH TOOL COMPANY • PERFORATING GUNS ATLAS CORP. • SCHLUMBERGER WELL SURVEYING CORP. • WELEX JET SERVICES, INC. WELL PERFORATORS, INC. • THE WESTERN COMPANY

perforating operation and the wire line setting of a Baker Bridge Plug, or a Baker Production Packer can be performed from a *single set-up* by the wire line service organization you select, with definite *savings in time and money.*

Consider also, the advantages of accurate correlated measurements:

(a) wire line measurement while logging the well;

(b) wire line measurement for gun perforating; followed by

(c) wire line measurement for setting Baker Bridge Plugs or Baker Retainer Production Packers.

WHY NOT FIND OUT how you can save wear and tear on tubing (or drill pipe) with *wire line setting?*—Find out also how a Baker Production Packer set on a wire line for dual-zone production, saves almost one-half the cost of drilling two single-zone wells to the same two zones!—Why not get the facts as to how a Baker Bridge Plug provides a positive, leak-proof shut-off against any pressures—how it can be *set on a wire line in a few hours,* and drilled out more readily than any other bridge plug?

Ask Any Baker Representative
—wire, phone or write to any Baker Office for facts and specific recommendations.

BAKER OIL TOOLS, INC.

HOUSTON • LOS ANGELES • NEW YORK

...and in all active fields throughout the United States.

Of World Oil Men

The Nomads Entertain in Houston . . .

Attending a recent meeting of the Houston Chapter of NOMADS were the following visitors, standing left to right, W. M. Cheney, Shell Oil Company, Casper, Wyoming; Glenn Byers, Shell Oil Company, Houston; F. W. Haeseker, Asiatic Petroleum Company, Houston; Val T. Billups and Frank A. Nice, Jr., Texas Gulf Producing Company, Houston; C. L. Garland and P. E. Thomas, Mene Grande Oil Company, Maracaibo, Venezuela; Seated are E. E. McGar, Shell Caribbean Petroleum Company, Maracaibo, Venezuela; R. J. Young, Shell Oil Company, Houston; R. M. Vandergraat, N. V. Bataafsche Petroleum Mij. Utretcht, Holland; Sydney M. Sims, Iraq Petroleum Company, London and R. B. Starke, Santa Fe Drilling Company, Maracaibo, Venezuela.

. . . and in Los Angeles

International guests present at a recent meeting of the Los Angeles Chapter of Nomads included, standing left to right, Paul G. Reed, in charge of foreign personnel, The Texas Company; Alvin W. Tucker, Trinidad Oil Field Service Co., Trinidad; John G. Luttrell, Socony-Vacuum Oil Company, Venezuela; George E. Kunkel, Colombian Petroleum Company, Colombia; Richard C. Harris, Union Oil Company, Costa Rica; Haroldo Ramos da Silva, Conselho Nacional do Petroleo, Brazil. Seated are Thomas A. Moore, Texas Petroleum Company, Venezuela; Edward A. Rosenquist, Socony-Vacuum Oil Company, Venezuela; John C. Sample, General Petroleum Company, speaker; Jesse F. Roberts of D. & E., Iran; Karl B. Jouman, Basrah Petroleum Company, Iraq; and Geonisio C. Barroso, Conselho Nacional do Petroleo, Brazil.

T. L. DONOVAN, assistant to the president of Sinclair Somal Corporation, a subsidiary of Sinclair Oil Corporation, has been named head of Sinclair Somal's Magadiscio, Italian Somaliland, office.

•

J. R. CARROLL, senior assistant manager of Texas Petroleum Company and subsidiaries, has succeeded W. I. WOODSON as general manager of the company's Venezuelan Division and as president of S. A. Petrolera Las Mercedes. Woodson resigned to enter private business in Venezuela and has been retained as consultant by both companies.

Carroll began his service in The Texas Company in 1909, and has had wide experience in Latin America, beginning in Mexico in 1920. He has served as accountant, auditor and assistant manager in Venezuela, Argentina and Colombia.

•

WILLIAM N. HOLT, recently named manager of foreign operations in the eastern hemisphere for The Texas Company, for the past five years has been managing director of Caltex (Ireland) Ltd., an affiliate of Regent Oil Company, Ltd., a British company jointly owned by California Texas Oil Company, Ltd. and Trinidad Leaseholds, Ltd. A native of North Carolina, Holt attended the University of Wisconsin. He joined Texaco in 1937 at Norfolk, Va. He has been in foreign sales work since 1942, first in Latin America and later in Europe. He joined Caltex in 1947.

•

VERN H. HUNTER has been made management assistant of Imperial Oil Limited's Western Canada producing division to succeed G. L. COLPITTS, who has been transferred from Calgary to become operations advisor in Imperial's Producing department at Toronto.

•

DONALD I. LAWLESS, manager of exploration for Canadian Bishop Oil, Ltd., has been elected a member of the company's board of directors. Presently stationed in Calgary, Alberta, Lawless has been prominently identified with the activities of Bishop Oil Company, the American parent company, in Mid-Continent fields. He is a geologist.

•

ROY M. FLY of Los Angeles has been appointed foreign coordination officer in charge of the Foreign Coordination Office (Materials) of Petroleum Administration for Defense, succeeding MONTY GARRISON, JR., who has resigned to return to his business interests in Rio de Janeiro, Brazil.

Fly has been purchasing agent for Western Gulf Oil Company at Los Angeles since 1949 and has worked for the company since 1940. From 1935 to 1940, he was employed by Gulf Oil Corporation at Tulsa, Oklahoma.

He attended Oklahoma A. & M. College at Stillwater and the University of California at Los Angeles.

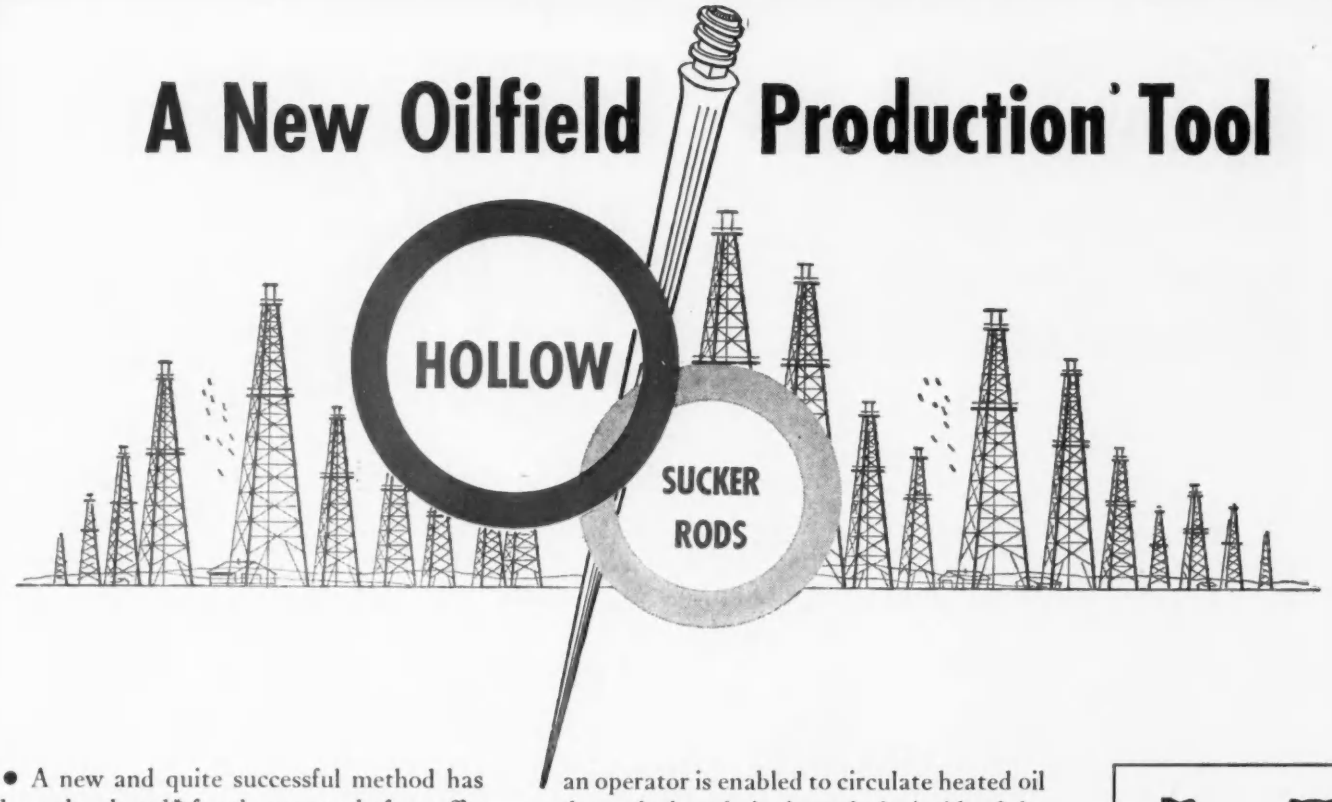
•

J. L. FORD, Creole Petroleum Corporation's district superintendent in Tía Juana, in the Lake Maracaibo area of Venezuela, has become acting division assistant manager at Maracaibo. L. A. SUMMERS, formerly district superintendent in Jusépin, Eastern Venezuela, was made district superintendent in Maracaibo.

FEDERICO BAPTISTA, assistant district superintendent in La Salina, Maracaibo Lake area, was made district superintendent in Caripito. HUGH WYNN will replace Baptista in La Salina.

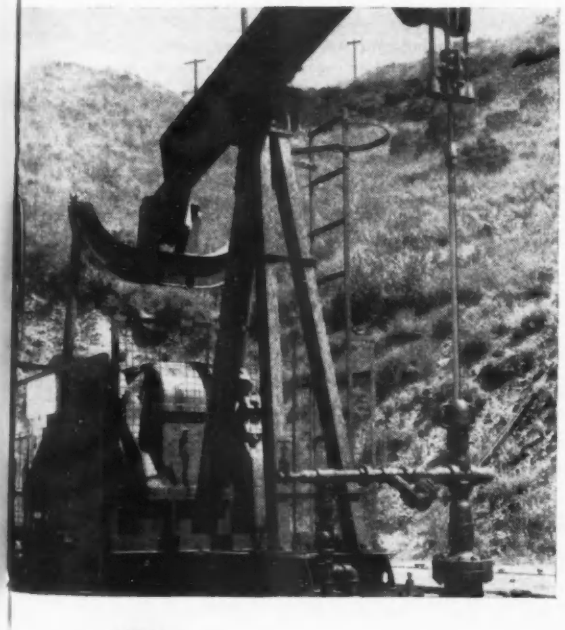
L. M. ELDREDGE was transferred from Quiriquire field to Tía Juana, replacing J. L. FORD. DOMINGO CASANOVA was transferred from Pedernales field to Jusépin as acting superintendent.

A New Oilfield Production Tool



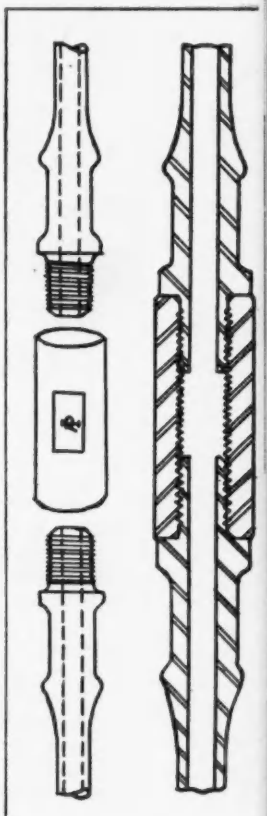
• A new and quite successful method has been developed* for the removal of paraffin or asphaltic deposits from oil wells. This troublesome problem is an expensive, time-consuming, and all-too-frequent one to production men in many of the oilfields in the United States. The loss of production and the cost of remedial work due to "waxing" problems is known to be one of the industry's major headaches connected with the production of crude oil.

By the use of the hollow sucker rod made from Shelby Seamless Mechanical Tubing, an operator is enabled to circulate heated oil down the bore hole through the inside of the hollow sucker rod and up the annulus between the rod and tubing *without interrupting the pumping of the well!* The heated oil flushes out the asphalt or wax which has become fluid and carries it out through the flow line to the tank of separator. This operation, taking only a few minutes, can be performed as a routine preventive measure without loss of production from the well instead of the conventional method of waiting until tubing or annulus is plugged with wax, then shutting down the pump and pulling and stripping the rods and tubing.



Capacity and Strength of HOLLOW SUCKER RODS made from SHELBY Seamless TUBING

The hollow sucker rod is, unless otherwise ordered, a double pin, Range 2 length of Shelby Seamless Steel Tubing having standard dimensions of 1⅛" O.D. by ⅝" I.D. with standard A.P.I. ⅞" sucker rod pins bored out and flash welded to the body of the rod. Made of A.I.S.I.-1035 steel, or equivalent, cold-drawn and finished annealed, the manufacturers of this rod say it has an adequate safety factor for wells of from 6500′ to 7500′ in depth and having polish rods loads of 17,000 to 20,000 pounds.



Sketch of hollow sucker rod showing double pin construction and standard A.P.I. couplings.

*Manufacturer's name on request.

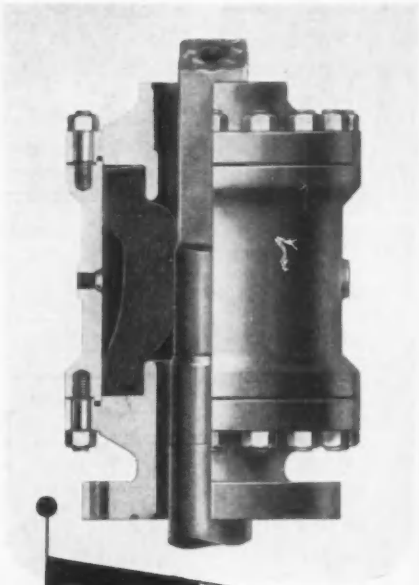
NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
(Tubing Specialties)
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS TRADE MARK

SHELBY SEAMLESS MECHANICAL TUBING

UNITED STATES STEEL

STANDARD
OF THE
PETROLEUM INDUSTRY
Since 1905



Regan type K
BLOWOUT
PREVENTER

Gives you complete blowout control at all times. Instantaneous closure can be made by remote control by applying pressure behind rubber packer. Inner and outer slot arrangement in moulded rubber packer prevents closure distortion. Normally open to full size of casing—will close around any size or shape of pipe, kelly or tool. No parts to change—no metal-to-metal parts to become inoperable. Thoroughly proven in actual use in all major domestic and foreign oil fields.
Send for detailed information.

51

Regan
Forge & Engineering Co.
SAN PEDRO, CALIF.
FORT WORTH, TEXAS
Exclusive Mid-Continent and Export Distributor:
MID-CONTINENT SUPPLY CO.
General Offices: Fort Worth, Texas
Quality – Wrought on the Forge of Experience

Operations Under Way in East Africa
A driller is at the controls at the scene of the first shot hole for the first seismic survey on Mafia Island, Tanganyika, East Africa, where D'Arcy-Shell exploration parties are engaged in survey operations.

A WORLD of OIL

By DON KLIEWER,
WORLD OIL Staff

SICILY: Macmillan Petroleum Corporation will undertake geological exploration of 30,000 acres of wholly-owned concessions in Sicily. A location will be selected for the immediate drilling of a test well to about 1100 feet . . . It is reported that Gulf Oil Corporation will begin exploration drilling shortly at a site adjoining Macmillan Petroleum Corporation's concessions . . . Anglo-Iranian Oil Company also is scheduling an exploratory well on the other side of the Macmillan concession.

ENGLAND: A 5000-foot test well is being drilled at Croxteth, in the St. Helen's area of Lancashire . . . Upon completion of the Croxteth test, another hole is to be drilled in the Widnes area, where the National Coal Board recently reported finding oil traces during drilling operations . . . Tests at Arreton, Isle of Wight, has reached 4800 feet and one at Radcliffe on Trent is drilling ahead at 2500 feet.

IRAQ: The new Zubair field near Basrah has just exported its three

when you're *Exploring* terrain like this ⇨

⬆ a swift survey like this...

will save months of this ⬆

Get the Air Picture First!

Speedy AERO surveys with mapping cameras or the airborne magnetometer bring significant data to your desk before you begin costly ground studies. You get the complete reconnaissance picture for any area, regardless of terrain. Thus the foot-slogging can be directed to the most promising areas.

In over a million miles of air survey experience, AERO's skilled mapping crews have aided the search for oil all over the globe, at a fraction of the cost of ground studies. Our photos yield valuable information on surface structures; our precise aero-magnetic maps give additional data on regional trends and basement structures. Let us speed your exploration.

AERO CREWS ARE AT WORK NOW IN CANADA . . . AFRICA . . . THE MIDDLE EAST AND FAR EAST . . . EUROPE . . . SOUTH AMERICA . . . AND THE U. S. A.

Our affiliate is CANADIAN AERO SERVICE, LTD., OTTAWA

AERO
SERVICE CORPORATION
PHILADELPHIA 20, PENNSYLVANIA
Oldest Flying Corporation in the World

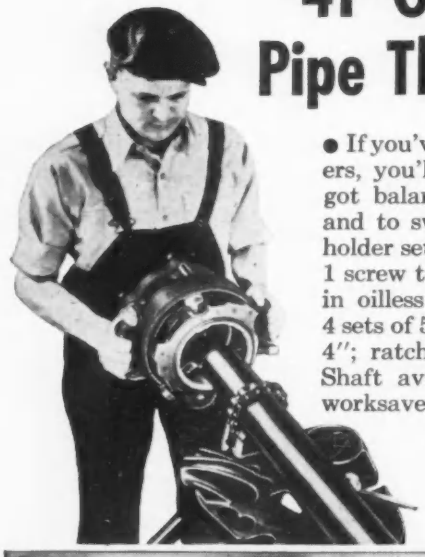
RIDGID means most service for your money!

No. 4P,
2½" to 4" pipe

Never before one so easy to carry—
easy to put on pipe...

RIDGID

4P Geared
Pipe Threader



● If you've rassled with old-style geared threaders, you'll go strong on this RIDGID 4P. It's got balanced loop handles—a cinch to carry and to swing onto pipe. Mistake-proof workholder sets to size before it's put on pipe—only 1 screw to tighten. Easy upkeep—drive pinion in oilless bronze bearing; safe enclosed gear. 4 sets of 5 high-speed steel dies, 2½", 3", 3½", 4"; ratchet handle. RIDGID Universal Drive Shaft available — also 4P for conduit. Buy worksaver 4P at your Supply House.

THE RIDGE TOOL COMPANY
ELYRIA, OHIO

RIDGID
Work-Saver Pipe Tools

millionth ton of crude. The field and the Fao terminal, 30 miles south of the field, are operated by Basrah Petroleum Company, which is owned by Iraq Petroleum Company . . . Total crude production from Iraq for the first quarter was 54,772,725 barrels . . . Basrah Petroleum Company set a new drilling record at Zubair recently when crude began flowing from Well 25 at 10,950 feet exactly 100 days after drilling operations began.

NEUTRAL ZONE: Full extent of the new oil reserve found by American Independent Oil Company's Persian Gulf concession discovery has not yet been determined, although this company's sixth test in the Neutral Zone between Kuwait and Saudi Arabia found Burgan sand crude at about 3500 feet. On a drill stem test, the well flowed at the rate of 2400 barrels a day of clean oil testing 31 gravity.

PAPUA: Drilling of the Omati well in West Papua has reached 12,770 feet, a record depth for wells managed by Anglo-Iranian Oil Company Ltd. . . . The previous record was 12,621 at Kariara 1 well in Central Papua.

GERMANY: Deutsche Vacuum Oel Aktiengesellschaft struck oil in the wildcat Voigtei 1 about midway between Aldorf and Steimbke oil fields at a depth of 1404-1542 feet. Drill stem test reports have not been made yet . . . Extension well Ploen 3 of Deutsche Erdoel-AG found the oil-bearing sandstone of Dogger beta at 6417 feet. Ploen 3 is situated in Wankendorf district about 984 feet southwest of the discovery well Ploen 2, which opened up the Ploen field in Schleswig-Holstein . . . Dickel 1, a new 4500-foot producer drilled by Wintershall AG. east of Diepholz, has opened up the fourth new oil deposit in the area between Weser and Ems within the past few months . . . With a daily average production of 37,915 barrels, German fields reached a new peak in the short month of February with total production of 1,061,619 barrels.

NETHERLANDS: Oil traces have been found in an exploration well drilled by The Netherlands Aardolie Mij. in the area between the Waal

The "Success Story" that can never be finished

The time was June 1928. Gulf had just introduced a revolutionary new motor oil—made possible by the invention of a new refining method. This remarkable new oil, which exceeded every quality standard of that day, was called Gulfpride—and was acknowledged to be "The World's Finest Motor Oil."

HERE was a motor oil so advanced there might well have been a temptation to leave it alone. But Gulf believes in this simple axiom: A good product is merely the beginning of a *better* product.

The development of that original Gulfpride was only the beginning of a program of persistent research that has continued over the past quarter-century.

Gulfpride has been improved again and again—to keep it well ahead of the increasingly exacting demands of advancing engine design.

Most recent result of this program of constant improvement is Gulfpride H.D., the remarkable high detergency motor oil.

And already, Gulf research technologists are again seeking new ways to make this fine product even better . . . new ways to make sure that Gulfpride will always be "The World's Finest Motor Oil."

Gulfpride

For Twenty-five Years . . .
THE WORLD'S FINEST MOTOR OIL

Gulf Oil Corporation • Gulf Refining Company

and Maas rivers, near the village of Andel (North Brabant). Further exploration is scheduled.

BRAZIL: Texas Gulf Producing Company has a contract to supply a proposed Manaos refinery with 5000 barrels of crude a day from its recently-purchased Ganso Azul concession in Peru.

PAKISTAN: A second well has been completed by Pakistan Petroleum Ltd. (Burmah Oil Company Ltd.) in Sui, Dera Bugti, Baluchistan, five miles from the discovery well. . . . Recommendation has been made to the government and Pakistan Petroleum by their consultant, C. Stribling Snodgrass, that gas from the field be used to generate electric power for irrigation and industrial fuel . . . The dispute between Karachi Oil Installation Workers Union and Burmah Shell Oil Storage and Distributing Company (Pakistan) Ltd., Caltex Oil (Pakistan) Ltd., and Standard Vacuum Oil Company has been placed before the Industrial Tribunal.

CZECHOSLOVAKIA: It is claimed that 1952's production goal was reached during the first ten months of the year and that the 1953 goal is 25 percent higher.

YUGOSLAVIA: Planned for this year is a 60-mile pipe line from Janja-Lipa gas field to Zagreb, with branches to villages and towns along the line.

POLAND: Last year's production of all fields can now be estimated at 1,966,035 barrels, based on calculations resulting from percentages reported earlier in which the government mentioned actual production data for post-World War II years . . . Reactivation of Ustryhie Dolne field, begun in October, 1951, has resulted in a loss of all investments. In fact, all further operations will cease until the arrival of new Soviet deep drilling equipment.

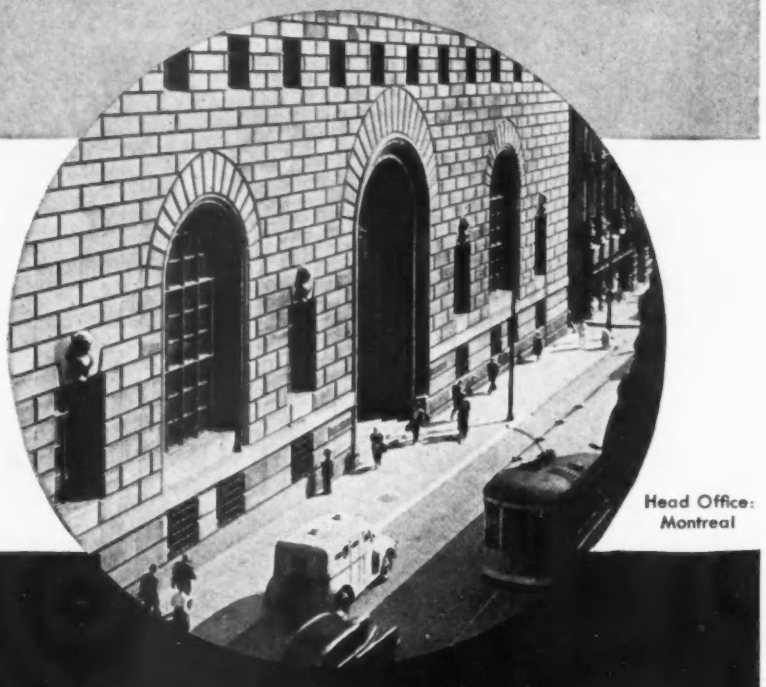
ROUMANIA: Crude production is caught between continuing strict Russian demands (in 1946, 68 percent of the country's crude yield was siphoned off by the Soviet army) and Soviet dismantlings of equipment (the Reds dismantled 48,000 tons of pipe line in November and December, 1944—60 percent of total Roumanian pipe line mileage) . . . Drilling in Boldesti fields has reached only 86 percent of the government's quota. A Bucharest Communist paper blames Boldesti workers with negligence and hostile attitudes.

RUSSIA: Soviet geologists have claimed discovery of an extensive oil slate deposit near the Kuibishev oil field . . . Air compressed secondary recovery method is now being applied to Baku area. Currently, 60 holes are equipped with automatic air lifts, and 100 more are scheduled to be brought into the program this year.

AUSTRIA: Through European Recovery Program and Mutual Security Administration Austria has received oil drilling and equipment worth $858,540.45 during the period from October 14, 1949, to May 28, 1952. All machinery and equipment thus imported is used in the Western zones for exploratory efforts in Upper

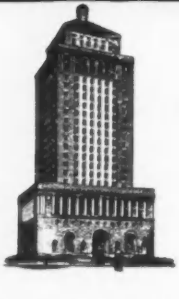
Canada's "Oil" Bank

. . . serving Canada's
fast growing Oil and Gas Industry



Head Office: Montreal

For a free booklet describing
our unique *Special Bulletin Service*,
write: Oil and Gas Dept.,
102 Eighth Ave., Calgary, Alta.



Branches throughout Western Canada's oil and gas fields

THE ROYAL BANK
OF CANADA

Total assets exceed $2,675,000,000

A. P. I. PIPE COUPLINGS

All Sizes and Types for Oil Field Use

LINE PIPE COUPLINGS A.P.I.
1/8" to 12"—Seamless and Special Processed—Black or Galvanized

PLAIN TUBING COUPLINGS A.P.I.
1" to 3"—Seamless

EXTERNAL UPSET TUBING COUPLINGS A.P.I.
¾" to 3½"—Seamless

CASING COUPLINGS A.P.I.
4½" to 13⅜"—Long or Short

HYDRAULIC COUPLINGS
⅛" to 3"—Seamless

REAMED AND DRIFTED A.I.S.I.
¾" to 12"—Seamless or Spl. Processed

DRIVE PIPE COUPLINGS
⅜" to 12"—Seamless or Spl. Processed

Consult Our Nearest Quick Service Sales Office:

Albany, N. Y.—Albert L. Becker, 434 Clinton Ave.
Baltimore—Ted Barto, 2301 N. Charles St.
Buffalo—W. E. Spencer Assoc's, 241 S. Elmwood Ave.
Chicago—Harry A. Jay, 122 So. Michigan Ave.
Denver—Earl H. Jones & Co., 1863 Wazee St.
Detroit—Thomas L. Osberger, 19451 Livernois Ave.
Erie, Pa.—R. J. Maggi, Box 711
Falmouth, Mass.—Wm. F. Bennett, 53 Minot St.
Ferguson, Mo.—Wm. H. Heckenberg, 635 No. Florissant Road
Houston—Henry H. Paris Distributor, Inc., Box 932
Los Angeles—James A. Riordan Co., 1400 Santa Fe Ave.
Minneapolis—Lin J. Krause, 200 Lumber Exchange
Narbeth, Pa.—J. W. Worthington, 105 Forrest Ave.
Newark, N. J.—Murray Eskin, Industrial Office Bldg.
New York—Henry Stein, 50 Cliff St.
Portland, Ore.—Earl H. Jones & Co., 1233 NW 12th Ave.
Richmond, Va.—P. C. Abbott & Co., Mutual Bldg.
San Francisco—Earl H. Jones & Co., 1150 Folsom St.
Seattle—Earl H. Jones & Co., 819 Thomas St.

FACTORY 'PHONE: WOODSDALE 3296

WHEELING MACHINE PRODUCTS COMPANY

ELM GROVE STATION — **WHEELING, W. VA.**

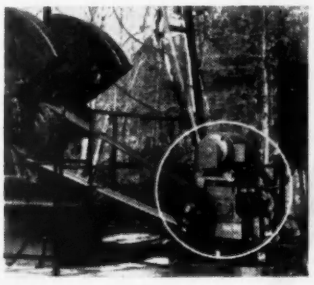
KEEP YOUR WATER SYSTEM FREE!

PUR-O-SAN

the complete intake water conditioner FOR SECONDARY OIL RECOVERY

INCREASES INTAKE RATE!
PREVENTS PLUGGING!
PREVENTS CORROSION!
NON-POISONOUS!
READILY SOLUBLE!

PUR-O-SAN COMPANY
DIVISION OF BRADFORD CHEMICAL CO., INC.
20 Congress Street • Bradford, Pa.



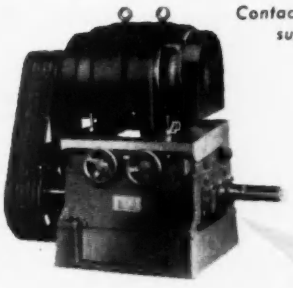
Typical oil field installation on single reduction pumping unit pumping 10, 13, 16 and 19 SPM.

New!

VARY SPMs at the TWIST of a WRIST!

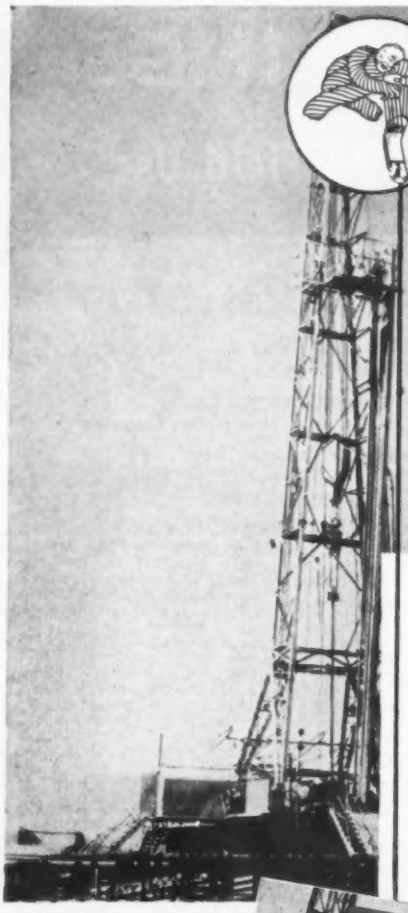
4-SPEED TRANSMISSION
1 THRU 60 H. P.
FOR ALL TYPES and SPEEDS of ELECTRIC MOTORS and GAS ENGINES

Consider these applications and problems! Single Reduction Pumping Units—Pump as slow as conditions require—Double Reduction Units too—Tri-Plex and Centrifugal Pumps for Water Flood—Offers 4-Speed Flexibility—Pipe Line Gathering Pumps—Correcting Cold Weather Difficulties—Repressuring Plants—Geared Powers—Refineries—Drilling Rig Accessories—All Turner Transmissions are especially designed and guaranteed for continuous Oil Field Duty.



Contact your local oil equipment supply store or write:

TURNER UNI-DRIVE Company
3418 Terrace Street Kansas City 8, Missouri



"Nearly TWICE the Ton Mile Service"...with Tuffy®
JACKKNIFE ROTARY LINES

Says Driller in the Illinois Fields
(Name on request)

"All previous lines used on the same equipment—on the same type of job—failed after the fourth well, being so drum crushed that they would not run them," says this Illinois driller. Yet, when he switched to Tuffy, the rope still showed no signs of wear after drilling 7 wells!

Cut Rope Costs with New, FREE
"Handbook of Wire Rope for Well Drilling"

All the latest, useful facts on • Oilfield Rigs • Drilling • Cut-Off Procedures • Field Care and Use of Wire Rope. Mail coupon for FREE COPY.

FREE Ton-Mile Indicator
Simplifies Cut-Off Problems!

By measuring line work, you can quickly establish correct cut-off time...avoid wasteful cutting or overloading.

Mail Coupon NOW!

Why Tuffy ROTARY LINES Can Give You Nearly Twice The Service

Special steels—special design—special construction is the answer! Tuffy *Jackknife* Rotary Line is designed by wire rope specialists to spool and reeve better on the smaller sheaves and drums of the jackknife rigs. Tuffy *Standard* Rotary Line is designed for easy spooling on standard rigs and for deeper drilling with jackknife rigs. Both give you higher resistance to abrasion, shock loads, drum crushing and internal friction. Save rope costs by putting Tuffy on your next job.

union Wire Rope **corporation**
Specialists In Wire Rope and Braided Wire Fabric
2104 Manchester Ave., Kansas City 3, Mo.

☐ Please have a Union Fieldman deliver my FREE Ton-Mile Indicator and Union Log Book and explain its use.
☐ Please send FREE copy of "Handbook of Wire Rope for Well Drilling."

*Firm Name*_____
*By*_____ *Title*_____
*Address*_____ *City*_____ *State*_____

0-6

Austria. Salzburg and Styria provinces . . . Late reports say Soviets failed to find oil in Fischamend area drilling, and that they have now moved toward Baden, ten miles south of Vienna, and to the eastern hills of Leitha mountains . . . And that movement may result in trouble: this hilly region is clearly Austrian and connected in no way with "German Assets," and the Soviets have moved in in total disregard of world opinion of the law . . . OROP, allegedly joint Austrian-Russian monopoly distributor for Soviet Mineral Oil Association oil products, has established retail service stations in Salzburg, U. S. zone, despite earlier claims that activities would be restricted to Soviet zone and Vienna only.

HUNGARY: Rationed volumes of gasoline and other by-products have been cut again due to further decline in production of Lispe field in order to meet the agreed level of delivery to the Soviets . . . Currently the nation's No. 1 oil producer, Lispe field will soon be outproduced by Mezeotur area due to the latter's rapid development since its discovery in 1951. . . . Most of the crude from Lispe and Bekes fields goes to the Ukraine under a two-year-old order by the Soviet-dominated shipping company Meszhert calling for 300 tank cars daily.

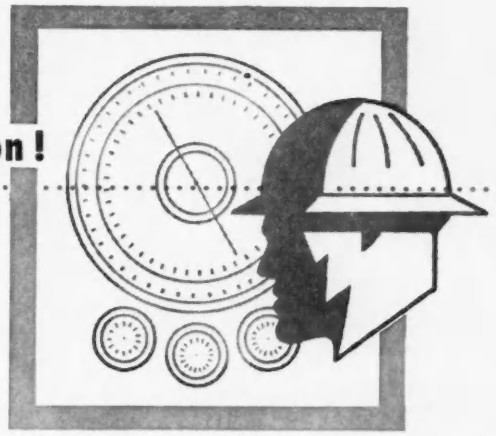
BAHRAIN: Plans are reportedly underway to utilize waste gas from Persian Gulf oil fields to provide low-cost heating and lighting for homes.

INDIA: Encouraging signs have been reported in the Bengal basin oil prospecting program now underway . . . Evidence of oil and high-pressure gas have been found in Assam Oil Company's exploratory test at Naharkatiya, which is drilling ahead at 10,016 feet . . . A deep drilling test is being planned at Digboi to test the east end of the Jaipur structure which is oilbearing at Naharkatiya . . . Government geologists reportedly have discovered kerosine oil at Seonda, Datia District . . . Standard Vacuum Oil Company reportedly has submitted a proposal for exploration at West Bengal.

CANADA: An unconfirmed report indicates that a big gas well has blown in about 300 miles north of known

OPENS BY WEIGHT OF DRILL PIPE....

with positive surface indication!



HALLIBURTON'S *NEW* HYDROSPRING TESTER

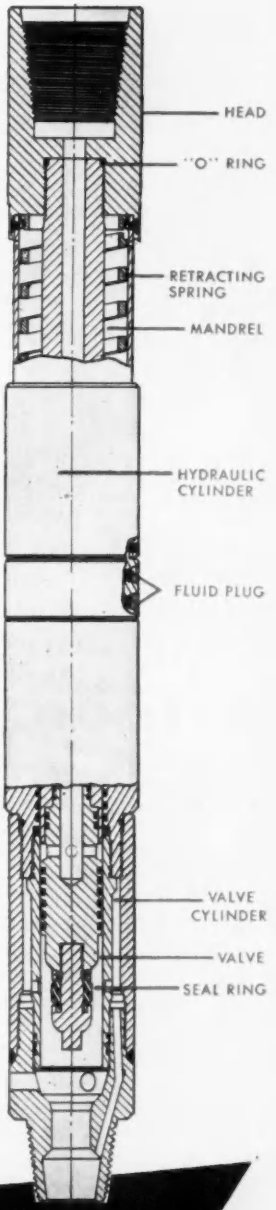
MORE THAN EVER, HALLIBURTON'S BEST FOR YOUR DRILL STEM TEST!

Now you have a testing tool that eliminates rotation, dropping of bar, or turning of J-slots to open. Hydrospring opens easily and positively by *weight of drill pipe* – a major step forward in the vital business of well testing.

And there's no guesswork about the Hydrospring Tester being open. A slight jar of the drill pipe and definite movement of the weight indicator needle give proof positive at the surface that the tool is open.

Here's the record of a recent testing job at Odessa, Texas: Total depth–11,850′; packer set–11,777′; TC Valve run three joints above tester; weight on tester–25,000 lb.; time to open tool–3′ 30″.

This is just one of more than 1500 perfect runs scored with Hydrospring.



There are additional advantages that set Hydrospring above ordinary testing tools: it is a combination tool requiring fewer assemblies; it can be run in rapidly to reach bottom quickly; it permits reversing off bottom simultaneously with taking closed-in pressure. And it can be rotated coming out of hole.

This miracle of modern testing is the result of Halliburton's continuous, energetic research and hard-won experience in the field. Combined with the Bourdon Tube Pressure Recording Device, this trouble-free, time-saving tool offers many exclusive features that make Halliburton best for your drill stem test!

Take advantage of Hydrospring Tester on your next job. Your Halliburton Testing Operator, only minutes away, is ready to swing into action when you call. Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

HALLIBURTON

YEARS AHEAD IN DRILL STEM TESTING!

Higher TORQUE CAPACITY

in New, more compact air-actuated clutch

Twin Disc announces the first of a new series of air-actuated clutches. Available now in two and three plate 24" sizes, the new model clutches possess many outstanding design features for greater performance.

To meet installation limitations, they have been designed for minimum weight, width and inertia mass—yet with even greater torque capacity.

Air-cooled release springs, operating in conjunction with new flat release valves employing a proved diaphragm seal, provide positive, quick-action release. Transmission of clamping force through slotted asbestos plate for adequate insulation, assures long diaphragm life.

Why not specify Twin Disc on your designs requiring air-actuated clutches? Contact your nearest Twin Disc Factory Branch Sales Office or the Factory for engineering recommendation.

New Model PO Advantages

1. Lighter weight—reduced inertia mass.
2. Higher torque capacity.
3. Narrower clutch width.
4. Positive plate release feature.
5. Large low rate release springs well removed from heat source.
6. Positive leakproof diaphragm insulated by asbestos from pressure plate.
7. Cooling pockets and slots designed for optimum ventilation.
8. Flat, compact new release valve design.
9. Optional "come home" feature.
10. No line lubricators required.
11. Easily serviced.

Built for a Long Life . . . Backed for a Lifetime

TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES
REG. U.S. PAT. OFF.

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin • HYDRAULIC DIVISION, Rockford, Illinois

BRANCHES: CLEVELAND • DALLAS • DETROIT • LOS ANGELES • NEWARK • NEW ORLEANS • SEATTLE • TULSA

fields on the British Columbia side of Peace River area. If true, a significant reserve of gas may be added to the known reserves of the region . . . Rio Tinto Alberta Oils, Prado Oil & Gas Company, Punch Petroleum and Triumph Oil Corporation will merge shortly into a new company to be known as Rio-Prado Consolidated Oils . . . Bailey Selburn Oil and Gas Ltd. and Selbay Exploration Limited have indicated a 3½-mile north extension to the Medicine Hat gas field in Alberta with their 1197-foot Baysel Medicine Hat 10-13, which tested 3.5 Mmcf of gas daily between 1216 feet and 1227 feet . . . A $9 million project to loop 135 miles of the Interprovincial oil pipe line between Regina, Saskatchewan, and Gretna, Manitoba, has been announced . . . The biggest oil and gas land play in Alberta since the rush into the far northwest has developed around Lesser Slave Lake, beginning near the Amerada Petroleum Corporation's development at Sturgeon Lake . . . Pacific Petroleums Ltd. and associates have completed an 887,000 cubic foot daily gas well in the southeast corner of the Fort St. John field in British Columbia . . . Contracts have been let to eight firms to speed construction of the $76 million Interprovincial Pipe Line Company's 635-mile extension from Superior, Wisconsin, to Sarnia, Ontario.

Baden-Wuerttemberg Well Still Flowing

The Baden-Wuerttemberg discovery, which caused wide interest early this year, is flowing at a continued rate of slightly more than 260 barrels a day. The hole, drilled to a depth of 2297 feet along the railroad between Karlsruhe and Heidelberg, was originally to serve for structural studies. Baden's major oil-suspected area lies farther south, around Bruchsal.

A 2400-foot pipe line has been laid to transport the crude to the Wiesloch-Walldorft rail station. The flow of crude has been interrupted for the lack of tank wagons.

Last year's total production of oil in the Baden area was only 106,000 barrels, about .8 percent of West Germany's total.

To All Rotary Hose Purchasers:

BE SURE THE HOSE YOU BUY...

CAN BE REPAIRED!

COUPLING—The original Barney Coupling is the only coupling that is stronger than the hose itself. It is the only coupling that can be reset to save your hose from the scrap heap.

CORD CONSTRUCTION—Goodall's flexible cord design provides the extra strength to withstand torsional twist . . . thus eliminating the cause of more than 90% of rotary hose failures.

FLEXIBILITY—Goodall Long-Life can be coiled into a convenient unit for transporting without slightest damage.

PERFECT BALANCE—The Goodall method of winding the multiple cords of the carcass and the steel cables of the pressure element at corresponding angles assures perfect balance.

GREATER STRENGTH—By actual test, Goodall Long-Life is the strongest hose ever built and it retains its strength better than any other hose.

REPAIR SERVICE—Goodall Rubber Company is the only rotary hose manufacturer that can protect your investment with a maintenance plan. Goodall maintenance provides a repair department in Houston where any length of Long-Life that meets with an accident can be renewed for the rest of its normal life. No length of Long-Life repaired in our shop has ever failed in service.

SALVAGE VALUE—Substantial allowances are made on every set of Barney couplings returned.

NO PREMIUM PRICE—The extra quality, longlife and high salvage value of Goodall Flexible Cord costs no more than ordinary rotary hose.

...and that means GOODALL LONG-LIFE with the Built-in Barney Coupling

There is no end to the service you can get from Goodall Long-Life Rotary Hose. First, maximum initial life is assured by the Goodall design which has proved the strongest, most flexible rotary hose ever built. But if your Goodall rotary hose should meet with an accident, the Barney Coupling can be reset to make your hose as good as new for the rest of its normal life. So . . . instead of being scrapped . . . your Goodall Rotary Hose can be back on your rig in a hurry for thousands of extra feet of tough drilling.

That's why we say to all Goodall Rotary Hose owners: NEVER DISCARD A GOODALL ROTARY HOSE UNTIL YOU CONTACT US. And that's why we suggest to all rotary hose users: BE SURE THE HOSE YOU BUY CAN BE REPAIRED. Thanks, Barney.

GOODALL RUBBER COMPANY

TRENTON, N. J.

GOODALL RUBBER COMPANY OF TEXAS: Houston, Odessa, Texas.
GOODALL RUBBER COMPANY OF CALIFORNIA: San Francisco, Los Angeles, Seattle, Salt Lake City, Portland.
GOODALL RUBBER COMPANY: New York, Philadelphia, Pittsburgh, Chicago, Denver, St. Paul, Detroit.
EXPORT: Goodall Rubber Company, Trenton, N. J.
STOCKING DISTRIBUTORS: Texas and Louisiana—Houston Oil Field Material Co.; Wilson Supply Co.
Oklahoma—Iverson Supply Co.

GOODALL HAS BEEN FIRST WITH EVERY WORTHWHILE ROTARY HOSE DEVELOPMENT

USE KINZBACH WHIPSTOCKS AND MILLS TO SIDETRACK YOUR HEADACHES

Type "A" Mill

Type "D" Mill

Type "H" Mill

Type "I" Mill

Kinzbach Whipstocks can be set at any depth and require no support for the bottom. Positive setting slips prevent slipping or turning in the hole. The Kinzbach hinge arrangement assures that the top of the Whipstock will be close against pipe wall at all times, permitting easy passage of drilling tools. Setting trigger always locates the Whipstock between couplings so that the window will be within one joint. Kinzbach Whipstocks are available in all popular casing sizes through your supply store.

Use Kinzbach Milling Tools for every whipstocking or metal cutting operation. They have high-speed tool steel inserts which are ground and set at the most efficient angle for fast, uniform cutting action. Shown at left are four popular models—see your Kinzbach Catalog for a description of the complete series of Milling Tools.

KINZBACH TOOL CO INC

KINZBACH TOOL CO., INC.

P. O. Box 277 Houston, Texas

Export Office: 74 Trinity Pl., New York, N. Y.

Spain Drilling Project Procedure Is Outlined

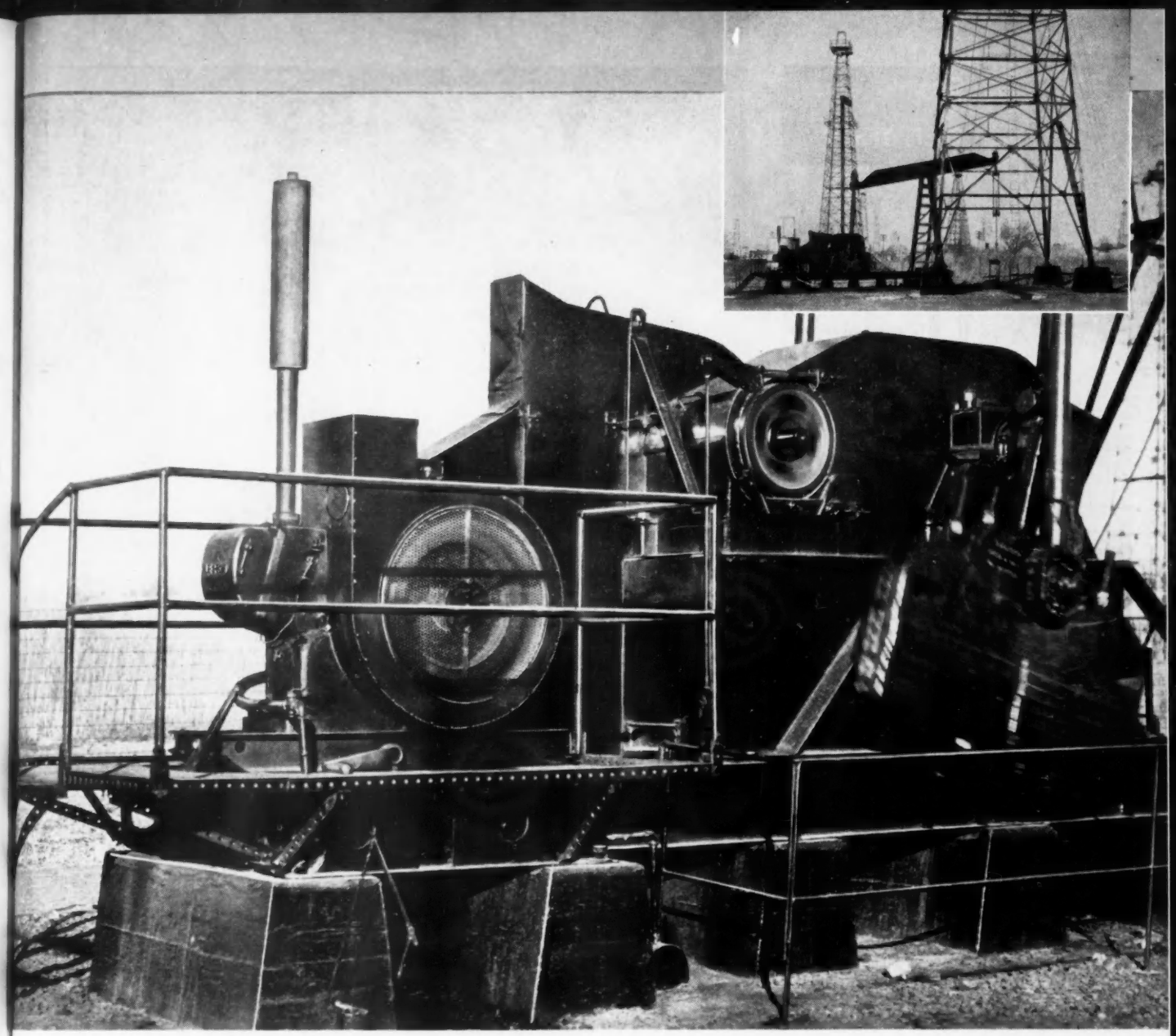
An American syndicate composed of General American Oil Company of Texas, Delhi Oil Company, Delta Drilling Company and certain individuals including DeGolyer and MacNaughton and C. Stribling Snodgrass (formerly a vice president of Bechtel and deputy administrator in PAD) have a 50 percent interest in an operating partnership, known as Comision de Investigaciones Petroliferas Valdebro, to explore for oil in Spain. The remaining 50 percent interest is held by the Spanish Government's agency, Instituto de Nacional de Industria (INI).

The operating group (Comision) will continue as a partnership until a commercial discovery of oil is made and then will change to a Spanish corporation with the ownership equally divided between the American group and INI. Provision has been made that the American group can withdraw its profits, if any, in dollars.

Delta Drilling, representing the group, is working under contract to INI drilling an exploratory well, Marcilla 1, near town of Marcilla in Navarro Province in the Upper Ebro Valley in northeast Spain. Geophysical work is continuing by Geophysical Service Inc. over the concession area which covers 175,000 acres. Additional acreage is being applied for from Spanish government.

The wildcat test at the end of April was drilling below 5000 feet of planned test to 12,000 or 12,500 feet. Topographically, the location of the wildcat is in an exposed valley in a broad regional basin just south of the Pyrenees. Structurally, the area is a series of long narrow folds approximately parallel to Pyrenees. There are several well-defined anticlines in the structure.

This is the opposite fold, south of the Pyrenees, to the valley on the north side in France where the major oil discovery was made at Lac in 1951.



Cost per HP-hour only half

of what major oil company considers good for engines on well-pumping service

Installation No. 1

Le Roi A288 pumped 50 barrels water, 70 barrels oil from 6,475 feet with an estimated load of 11-12 HP.

A288 operated for 1078 24-hour days — without being overhauled!

Operating cost per day — including pumpers' wages, fuel, and maintenance — only 90 cents!

Installation No. 2

Le Roi A288 pumped 180 barrels water, 10 barrels oil from about 6,475 feet with a load of 18 HP.

A288 operated for 911 24-hour days. Maintenance cost was only $.0017/HP-hr.

Operating cost per day — including pumpers' wages, fuel, and maintenance — only 69 cents!

That's real dependability! And economy! It's the kind of profitable performance Le Roi A288 owners in every producing area get every day.

And it's performance *you*, too, can have. See your supply house or Le Roi distributor — ask them to show you A288 installations. And have them tell you the reasons why the A288 is the only engine to be recommended by one major pumping-engine user for continuous service unattended for up to two weeks at a time!

LE ROI COMPANY

MILWAUKEE 14, WISCONSIN

Plants: Milwaukee • Cleveland • Greenwich, Ohio
Oil Field Headquarters: Tulsa Oklahoma

Service as Near as Your Telephone

Complete parts stocks . . .
Skilled mechanics on 24-hour call
. . . Unexcelled overhaul facilities

Oilfield Sales-Service Network

Oklahoma
Le Roi Company Branch — Tulsa
Carson Machine & Supply Co.—Oklahoma City

East & South Texas, Gulf Coast
Southern Engine and Pump Company—Houston, Kilgore, Edinburg, Dallas, San Antonio, Corpus Christi, Texas, and Lafayette, Houma, Louisiana.

North & West Texas, New Mexico
General Machine & Supply Co. — Odessa, Snyder, Texas.
Nortex Engine & Equipment Co. — Wichita Falls, Texas.

Kansas
Carson Machine and Supply Co. — Great Bend

Illinois — Western Kentucky
Western Machinery & Engine Company — Centralia, Illinois and St. Louis, Missouri.

Michigan
Hafer Engine Service — Reed City

Rocky Mountain Area
Gehring Equipment Co. —
Casper, Wyoming, Rangeley, Col.

Northern Louisiana & Mississippi
Ingersoll Corporation — Shreveport, Louisiana, and Jackson, Mississippi.

West Coast
Le Roi-Rix Machinery Co. — Los Angeles, Long Beach and Bakersfield, Calif.

Appalachian Area
P. C. McKenzie Co., Pittsburgh, Bradford.

Canada
Lucey Export Ltd.—Calgary, Edmonton, Alberta.

P-120

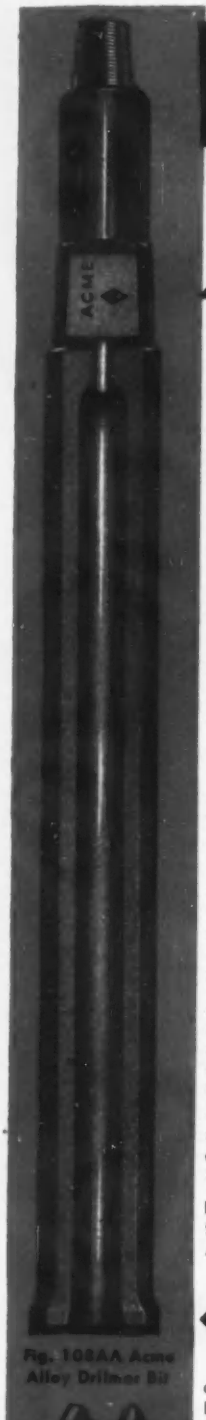


Fig. 108AA Acme Alloy Drillmor Bit

End View

Look for "Diamond A" on the square . . . Marks a genuine Acme Alloy Bit.

Greatest Name in Cable Tools

Acme

TRUSTWORTHY SINCE 1900

offers "Big Chief Alloy"

Greatest (percussion) DRILL BIT Advancement in ½ Century

Acme's New Alloy Bit —that increases hole footage 50% or more over "regular" bits — can now be had at little extra first cost.

This SENSATIONAL Bit was developed to meet great demand for bits fully capable of drilling hardest formations.

Another advantage: this Bit can be dressed and tempered (according to Acme's temperature color chart) in similar manner as recommended for regular carbon steel bits. (Write for chart.)

Deeper penetrating, extreme hardness makes Acme's Alloy Bit hold

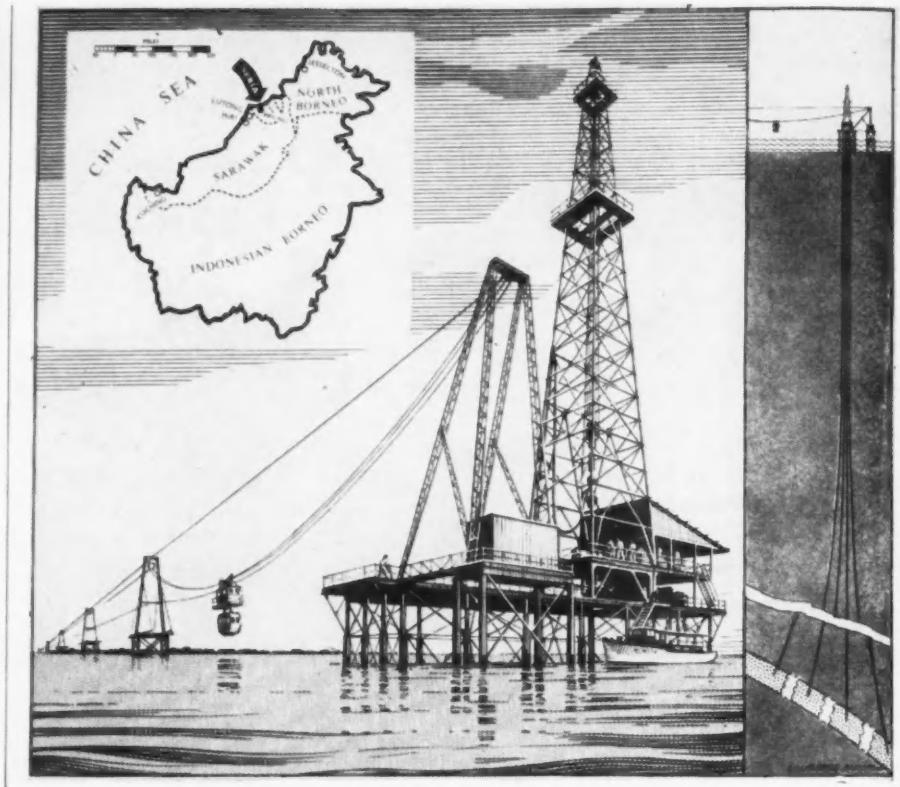
Extra Dressing Stock

cutting edge, wear longer and resist battering in toughest drilling. Practically no pin breakage.

It is proving positively the drilling world's finest cable tool Bit . . . Exclusively Acme's.

For ALL about Bit whose EXTRA footage pays-and-pays — write TODAY for Catalog and prices.

ACME FISHING TOOL CO.
PARKERSBURG W. VA.
Export Office:
19 Rector St., New York 6, N.Y.



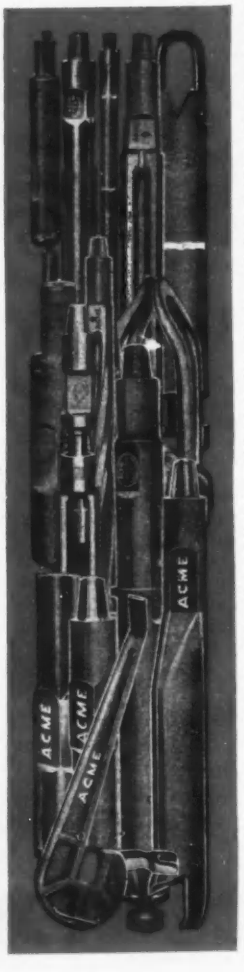
Four separate submarine wells can be drilled from this single fixed platform designed by Royal Dutch Shell for use in an effort to find oil in the South China Sea in what may be an underwater extension of the prolific Seria oil field. An aerial ropeway, capable of transporting personnel and equipment to the drilling site, was erected.

ACME DRILLING & FISHING TOOLS

There's More of EVERYTHING You Need in Acme Tools...

Acme's famous "Drillmor" Line not only provides a tool for every drilling or fishing operation but each tool possesses more of the finer functional features and superior product qualities you need for better in-hole results . . . because specialized toolmanship of over half-a-century accounts for the difference.

Driller's file isn't complete without Acme's Catalog and tool-use Manual and bit dressing (temperature color) chart. Free on request.



PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION MEMBER

Offshore Drilling Begun In the South China Sea

The first important submarine oil drilling operation in the British Commonwealth from a platform fixed on the sea bed is underway in the South China Sea. Initiated by Royal Dutch Shell, the plan calls for drilling wells into the sea bed in an effort to determine whether any submarine extension of the Seria oil field exists. Largest single oil field in the British Commonwealth, Seria now produces almost 40 million barrels of crude per year.

Four separate under sea oil wells can be drilled from a single fixed platform. Another interesting feature is an aerial ropeway connecting the drilling platform to the shore.

The drilling platform covers an area of 110 feet by 45 feet and is built on to a jacket composed of 28 24-inch diameter vertical steel guide piles tied together by horizontal and diagonal bracings of angle iron. The jacket rests on the sea bed in about 30 feet of water, and before the drilling platform was erected, steel bearing piles were inserted into the guide

piles and driven deep into the sea bed until the requisite bearing capacity was obtained. Four raking piles were also incorporated in the structure to confer greater stability and strength.

A special technique was employed for assembling and placing the jacket. The latter was fabricated alongside the shore in the sheltered river at Kuala Belait and supported on two barges clear of the water.

The entire assembly was then towed out to sea and the jacket lowered to the bottom by winches.

The long span of the aerial ropeway linking the drilling platform to the shore made necessary the placing of intermediate structures on the sea bed at 840 feet intervals. These structures were supported on smaller jackets of a type similar to those used for the main drilling platform, each being securely anchored by four bearing piles. Aerial ropeway jackets were fabricated ashore and taken out on barges to the locations and placed into position by heavy lift crane, the steel structure afterwards being erected at site on top of the jackets. Lifts of up to five tons for materials and equipment can be handed over the ropeway and, a transporter car for personnel has also been provided.

With the drilling platform, derrick, etc., already erected and the derrick now in position, it is reckoned that drilling operations will soon start.

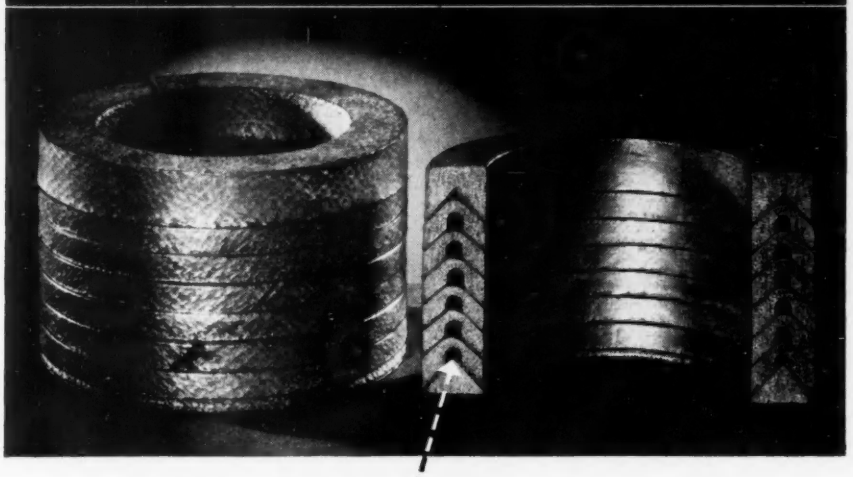
Fort Saskatchewan Gas Well a Major Discovery

Established as one of the major gas discoveries brought in to date in the general Edmonton area, Mid-Western-Union 7-28 rated an initial potential of 46,000 MCF daily. The well is in LSD 7 28-54-22 W4, near the town of Fort Saskatchewan and about 15 miles northeast of Edmonton.

A Viking sandstone success, the 7-28 venture is on pooled acreage owned by Mid-Western Industrial Gas Company and Union Oil Company of California. Union contributed about half a section to Mid-Western, and will have an over-riding royalty on natural gas produced.

The Mid-Western-Union test completed drilling in the Viking at 2540 feet. Production casing was cemented at 2537 feet, and the pay zone was

CHEVRON* PACKING



Exclusive hinge-like construction assures a positive, low-friction seal

At every pressure—from the lowest to the highest—Garlock CHEVRON packing provides a positive, low-friction seal. CHEVRON is ideally suited for use on hydraulic cylinders (both single-acting and double-acting), hydraulic rams, plungers of pumps and other reciprocating rods.

The exclusive hinge at the apex of each ring makes this packing flexible and sensitive to pressure changes. When the pressure is on, CHEVRON packing seals firmly both on the inside and outside edges. When the pressure is off, CHEVRON packing maintains a positive seal yet allows the ram or rod to return without binding. This automatic action not only prolongs the life of the packing but also increases the efficiency of the equipment on which it operates.

That is why many manufacturers of hydraulic cylinders, jacks, lifts and presses use Garlock CHEVRON packing exclusively.

Whether your job is plant maintenance or manufacturing new equipment, ask us about CHEVRON packing—the exclusive product of Garlock's own factories. Garlock CHEVRON packing is available in many materials such as: cotton duck with rubber or neoprene binder, asbestos with rubber or neoprene binder, hycar, "Teflon," and "Kel-F."

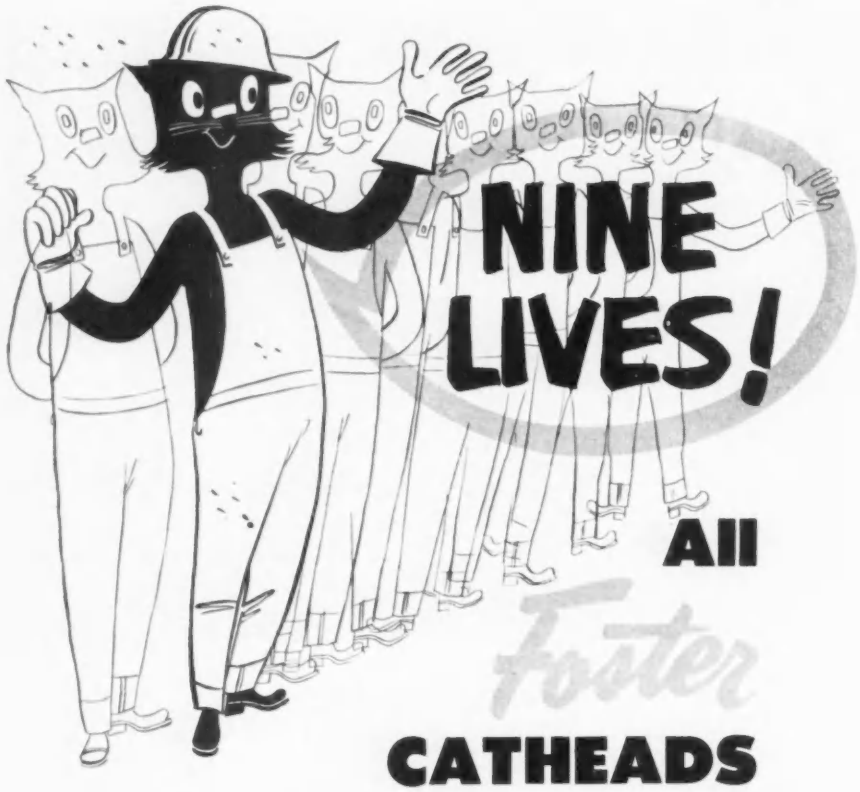
THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK
Tulsa, Okla. Houston, Texas Los Angeles, Calif.

Branch Offices in Most Principal Cities

*Registered Trademark

GARLOCK

PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS, RUBBER EXPANSION JOINTS



All Foster

CATHEADS have that and more!

Foster Catheads are famous throughout the industry for their long service. Many of them have been in operation on well after well for years without repairs of any kind. Heavy duty anti-friction bearings, ample lubrication, low pressure per square inch of clutch face, make this long life, repair-free service possible.

With Foster Spinning Catheads there's no need to hand wrap the spinning line; the line will not foul and wind up; and it can be stopped instantly by releasing the control.

For complete details of these two Foster Catheads see pages 1760 and 1762 of the Composite Catalog.

MIDGET SPINNING CATHEAD

SPINNING CATHEAD

PLUS FEATURES

Instant engagement without reducing lineshaft speed ● will spin and tong with forked line ● cannot engage accidentally.

★ OUR 25 YEARS OF EXPERIENCE ASSURE YOU YEARS OF SERVICE.

Foster CATHEAD COMPANY
P. O. BOX 1675 WICHITA FALLS, TEXAS

FACTORY REPRESENTATIVES

R. N. Bean, Los Angeles, Calif. Green Head Service, Oklahoma City, Okla.
Moore Specialty Co., Casper, Wyoming. Texas Warehouse Service, Corpus Christi, Texas
Tillery & Parks, Odessa, Texas. R. D. Cloninger, Lafayette, La.
Goode Equipment Co., Houston, Texas. Rotary Sales & Service, Ltd., Edmonton, Alberta, Canada
Woodco Sales & Service, Great Bend, Kansas. W. O. Nelson, Farmington, N. M.

perforated between 2413 and 2437 feet. Canadian Well Services Ltd. rated the well with an absolute open flow potential of 46,000 MCF daily. Bottom hole pressure was measured at 800 pounds per square inch.

Portugal Exploratory Test Finds Crude Near Lisbon

Companhia dos Petroleos de Portugal, owned 51 percent by the Portuguese government and 49 percent by the Swedish firm of A. Johnson & Co., has opened up a crude deposit about 25 miles north of Lisbon, Portugal.

The discovery well, Abadia 1, which was intended only as a shallow test, may warrant the first commercial oil production in Portugal. The well is situated on the crest of the Torres Vedras salt structure. The drilling site was selected upon the advice of German geologists employed by the Cia. dos Petroleos.

Oil was encountered in sandy-marly layers of the Malm at a depth of only 472 feet. Initial production tests resulted in a daily influx of approximately a quarter of a barrel of heavy oil.

When crude had been obtained for some several days, a strong influx of natural gas occurred. The hole is now shut in. Another deeper well with a larger diameter hole will be drilled at the same site.

McCarthy Readies Rigs For Bolivian Drilling

Glenn McCarthy of Houston, Texas, is reportedly ready to begin developing Bolivian oil properties after receiving recent government approval for concessions. McCarthy's concession covers 970,000 acres in Southeastern Bolivia, including 70,000 acres of partially proved oil land.

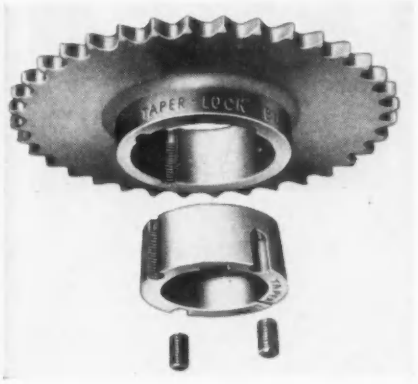
Two drilling rigs are scheduled to be sent to Bolivia—one capable of drilling to 8000 feet and the other to 12,000 feet.

Yacimientos Petroliferos Fiscales Bolivianos, the Bolivian oil agency, approved McCarthy's bids under the country's new oil law which went into effect in 1951 and which is designed to encourage foreign operations.

The 35-year contract, under a royalty agreement, covers 900,000 acres in the Agua Salado province of Gran Oroco and 70,000 semi-proved acres in Dos Monos province.

New Equipment

Supplementing Composite Catalog



Taper-Lock Sprockets

A line of Taper-Lock sprockets and Dodge roller chain which will be available from distributors' stocks has been announced by Dodge Manufacturing Corporation. A chief advantage of the new products is that they bring a new "off-the-shelf" availability to roller chain drives by the application to sprockets of the famous Taper-Lock principle already proved in V-belt, coupling, conveyor pulley and silent chain installations. Reboring of shafts is eliminated and shafts need not be turned and ground to get a tight fit.

This item supplements Dodge Manufacturing Company data on pages 1427-1430 of Composite Catalog, 19th Edition.

Circle No. 1 on Postcard

Spudder Derrick

For ease in handling long strings of casing weighing up to 150 tons, a heavy duty tripod type derrick is available as special equipment for the Bucyrus-Erie Co. 48-L spudder. The 70-foot 4-inch derrick is the first of its size and type designed especially for a spudder. Weighing 12 tons, the derrick is composed of four sections for easy erection, knockdown and transportation in the field. The main front lower section is constructed with four laced channels. The one piece upper section is fabricated of four channels at the front with chord angles at the rear corners, all laced together. The crown block, a separate unit, supports six casing line sheaves. The two triangular legs, built of chord angles rigidly laced together, are hinged to a special steel beam base for maximum stability. The base extends the length of the spudder base and derrick legs and is included with the derrick. The derrick is assembled on the ground. The two rear legs are hinged to the base and the unit is pulled upright by a cable attached to the bull reel drum and reeved over a gin pole which also is supplied with the derrick.

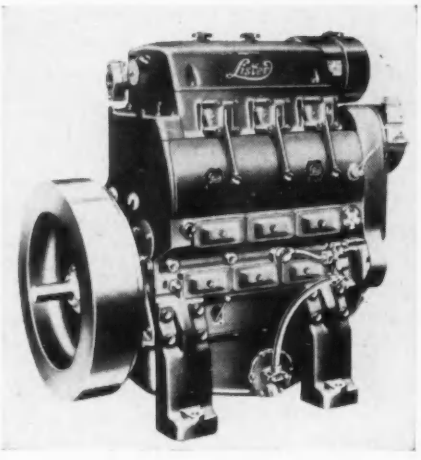
This item supplements Bucyrus-Erie Co. data on pages 977-982 of Composite Catalog, 19th Edition.

Circle No. 4 on Postcard

Lister Engines

Design features of the new "freedom range" of Lister diesel engines have been announced by the Engine Division of The National Supply Company, which recently became sole distributor within the continental United States for Lister diesels manufactured in England. The "freedom range" line of engines made in 1, 2, 3, 4, and 6 cylinders in a range from 8 to 54 horsepower was designed for high speed operation at tropic to Arctic temperatures without impairing reliablity. Upon arrival in the U. S., the engines are equipped with American accessories such as starters, generators and clutches.

This item supplements National Supply Company data on pages 3589-3720 of Composite Catalog, 19th Edition.



Circle No. 2 on Postcard

Pipe Line Trencher

Cleveland Trencher Company's Model 320 trencher is described in action photographs and dimensions and specifications are given in a new bulletin recently published. The trencher is described as the "modern pipe line trencher" because of its 12 crawler speeds for each of the five wheel speeds, the mounted full crawler, the low effective ground pressure, its perfect balance, and fast boom hoist control, among other features. Under good digging conditions this model turns out more than a mile of trench a day.

This item supplements Cleveland Trencher Company data on page 1281 of Composite Catalog, 19th Edition.

Circle No. 3 on Postcard

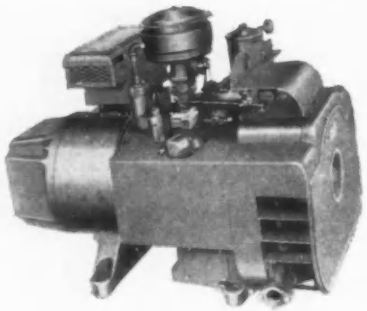
Save time! Keep informed! Circle numbers on postcard, page 275, corresponding to items on this page.

Centrifugal Compressors

A number of new Clark number 6 multi-stage centrifugal compressors are being assembled by Clark Brothers Company, Inc., to be used as the main air compressors on four of the country's new huge cat crackers now under construction. These compressors have a rated capacity to 100,000 cubic feet per minute and will be driven by steam turbines of approximately 8000 brake horsepower. Their over-all weight is 70 tons and the approximately 4½ feet diameter rotors will run in the speed range of 3600 revolutions per minute. The completed unit is pictured on the test stand.

This item supplements Clark Brothers Company, Inc., data on pages 1238-1239 of Composite Catalog, 19th Edition

Circle No. 5 on Postcard



Electric Plant

An advanced type air-cooled, gasoline-powered electric generating plant has been perfected by D. W. Onan & Sons, Inc. Its new vacuum-cooling system employs a centrifugal blower which draws cold air through the generator over the engine and discharges heated air out an 8-inch by 12-inch side vent. Known as the "CW" model, the electric plant is being produced in 5000-watt and 10,000-watt capacities.

This item supplements D. W. Onan & Sons Inc. data on pages 4032-4033 of Composite Catalog, 19th Edition.

Circle No. 6 on Postcard

New Packer

A new packer, the PS-3, has been introduced by Brown Oil Tools. With the exception of a top sealing cup, the PS-3 is identical to the Brown Duo-Pak. On shallow wells where most of the tubing weight is to be placed on the packer, the upper cup is not needed. The PS-3 can be used also to advantage when a large differential is present from below. Because of the large bypass ports which prevent piston action, the PS-3 is easy to run. In addition it is easy to set without left hand rotation and easy to retrieve without rotation. Working parts are enclosed and are not affected by debris or corrosive fluids and gases.

This item supplements Brown Oil Tools, Inc., data on pages 941-976 of the Composite Catalog, 19th Edition.

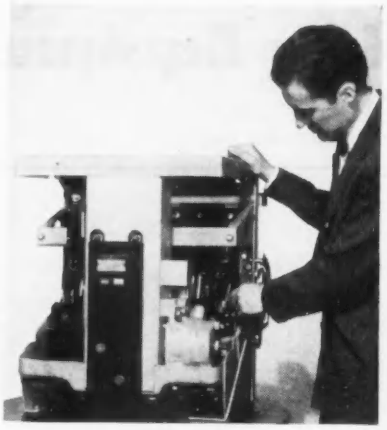
Circle No. 7 on Postcard

Oil Well Servicing Rig

Designed to speed servicing activities on wells in the 6000- to 10,000-foot depth bracket, the new mobile version of the Hoistmobile manufactured by Hopper Machine Works racks 10,800 feet of 2½-inch tubing in a 90-foot clear-height derrick. The three-section derrick is hydraulically raised in eight minutes or less, thereby reducing the time required to set up and begin servicing. The derrick mast jackknifes into folded sections. Excellent maneuverability on or off the highway partially stems from the Hoistmobile's ability to turn within a 42-foot radius aided by power-boosted steering on its two front tandem axles. Bethlehem Supply Company is California sales representative of Hopper Machine Works.

This item supplements Hopper Machine Works data on pages 2385-2404 of Composite Catalog, 19th Edition.

Circle No. 8 on Postcard



Voltage Switchgear

A complete new line of low voltage drawout switchgear (600 volts a-c and below) with standardized compartment construction and completely new air circuit breakers has been announced by the General Electric Company's Switchgear Department. Able to withstand 30-cycle momentary currents equal to their interrupting ratings (15,000 to 100,000 amperes), the new air circuit breakers used in the equipment make it possible to have fully selective tripping with all breakers applied up to their full interrupting ratings. Continuous current ratings range from 15 to 4000 amperes.

This item supplements General Electric Co. data on pages 1949-1968 of Composite Catalog, 19th Edition.

Circle No. 9 on Postcard

Line Blind

The new Robinson Duplex Line Blind has been developed to incorporate a positive line shutoff with a means of accurate measurement. When used as a line blind valve, the wedge-shaped blind and full flow plate are furnished. If used as a combination orifice fitting and line blind valve, the wedge-shaped orifice plate holder with orifice plate are included. If used as an orifice fitting only, the wedge-shaped orifice plate holder and orifice plate are furnished. An O-ring is used to form a pressure seal joint between the wedge and the body seat. Manufactured by the Robinson Orifice Fitting Company, the duplex is available in flange or welding neck models and uses standard Robinson catalog 500 orifice plates available in all orifice bores.

This item supplements Robinson Orifice Fitting Company data on pages 4465-4492 of Composite Catalog, 19th Edition.

Circle No. 10 on Postcard

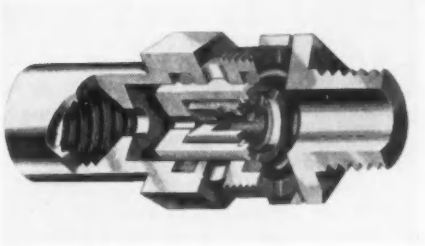
Save time! Keep informed! Circle numbers on postcard, page 275

Other New Equipment

Fire Wall Drain Gate

The P-D fire wall drain gate made by Maintenance Equipment Company is designed expressly for fire wall drains. Featuring a hinged disk with an O-ring installed around the circumference, the gate provides a positive seal, is easy to open and close and cannot be damaged or frozen by cold temperatures. All contact surfaces are cadmium plated to prevent rust and corrosion. The P-D fire wall drain gates are designed to hold several hundred pounds of pressure and are installed by welding to the drain pipe. They are available in sizes to meet required specifications.

Circle No. 11 on Postcard



Quick Release Valve

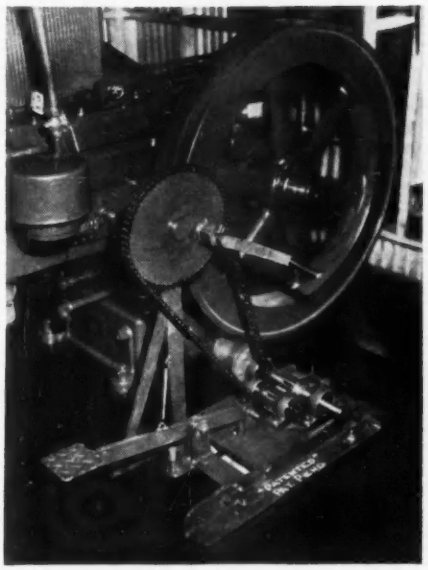
A quick release valve guaranteed not to chatter has been announced by Deublin Company. Designed to handle air pressure from 0 to 250 pounds per square inch on pneumatic clutches up to 1500 horsepower, the Deublin valve features light weight and compactness which permits its use on rotating elements without disturbing dynamic balance. The valve has a built-in orifice which prevents accidental removal of orifice from the line and eliminates possibility of pressure equalization responsible for chatter.

Circle No. 12 on Postcard

Motor Cleaner Solvent

A new solvent that cleans electric motors and generators while still assembled is manufactured by The Shaler Company. Called Shaler Generator-Motor Cleaner, it is listed under the Reexamination Service of Underwriters' Laboratories, Inc. Motors and generators are completely submerged in the liquid and then plugged into electric current for 3-5 minutes running. When the motor is removed from the dip tank it is dried with compressed air. Or, the solvent may be sprayed into the motor while it is in operation. The solvent does not affect wiring or insulation which is gasoline or oil resistant.

Circle No. 13 on Postcard



Engine Starter

A new type of engine starter is offered now by the Simplex Engine Starter Company. This inertia type starter operates by means of friction only, requiring no power energy. It operates both types of engines in horizontal and multi-cylinder lines, and has safety devices against backfire and speed-ahead hazards. It is manually operated and easily installed.

Circle No. 14 on Postcard

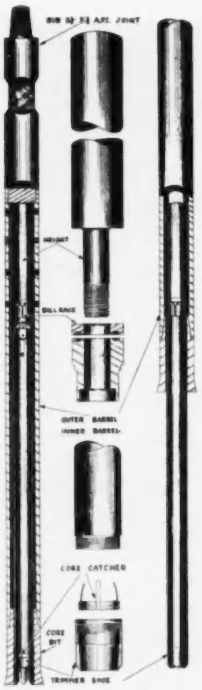
Polyvinyl Chloride Sheet

The Atlas Mineral Products Company has a new type of plasticized polyvinyl chloride sheet to supplement its Atlastavon linings series. The new product is resistant to alkalies, corrosive salts and most acids. It is applied by a new technique by trained applicators.

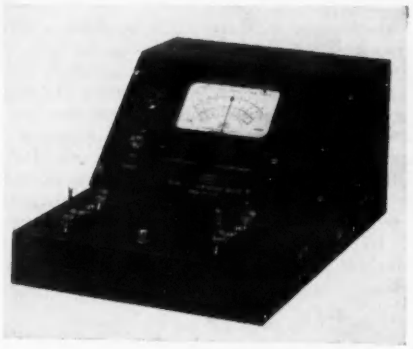
Circle No. 15 on Postcard

Core Barrels

The Churchill core barrels, models 303 and 404, have incorporated in them several late core barrel construction improvements. These include the torque absorber ball race designed to relay the rotating motion of the outer barrel to the weight above the inner barrel, thus allowing the inner barrel and trimmer shoe to remain motionless at all times, and the floating ring core catcher designed as an economy feature to improve operation by reducing stoppage and loss of core due to breakage and collapse. Churchill core barrels take larger cores. Core bits for these models are made of an alloy steel. Light weight tongs for these models also are made of alloy steel which gives them strength. Specifications and operating instructions are made available in a bulletin distributed by the manufacturers, East Side Machine Works.



Circle No. 16 on Postcard



Comparison Bridge

A new impedance bridge which serves as a comparison and limits bridge has been introduced by Southwestern Industrial Electronics Company. Designed for production line operation but capable of laboratory accuracy, the model E-1 comparison bridge provides low cost means of securing uniform characteristics in resistors, capacitors and audio-frequency inductances. The bridge features simplified controls and easy-to-read inclined meter, enabling unskilled operators to check thousands of components per hour. Five scales

Save time! Keep informed! Circle numbers on postcard, page 275

allow components to be matched or compared with standards within limits of 1, 2.5, 5, 10 and 25 percent at full-scale deflection. A bridge circuit applies three volts at 60 cycles to the components under test utilizing a transformer with a special bifilar winding to assure uniformity of two legs.

Circle No. 17 on Postcard

Mechanical Stirrups

Mechanical stirrups made by Albina Engine & Machine Works are easily moved from the shop to the job because they are light weight and can be lowered on rubbber-tired swivel casters. Safety features include three independent automatic braking systems so that should one fail, either of the other two would prevent the stage from falling. The Albina Stirrup is a swing stage stirrup equipped with either electric or air controls and accommodates standard widths up to 28 inches and any desired length.

Circle No. 18 on Postcard

Aluminum Alloys

Aluminum Company of America has announced two corrosion resistant alloys which are designed for use in welded assemblies. Designated XA54S and XC56S, they permit use of section thicknesses approximately one-half, or less, of other aluminum alloys commonly used for similar purposes. Alloy XA54S is of the aluminum-magnesium alloy family and has mechanical properties between those of 52S and 56S.

Circle No. 19 on Postcard

Pilot Regulator

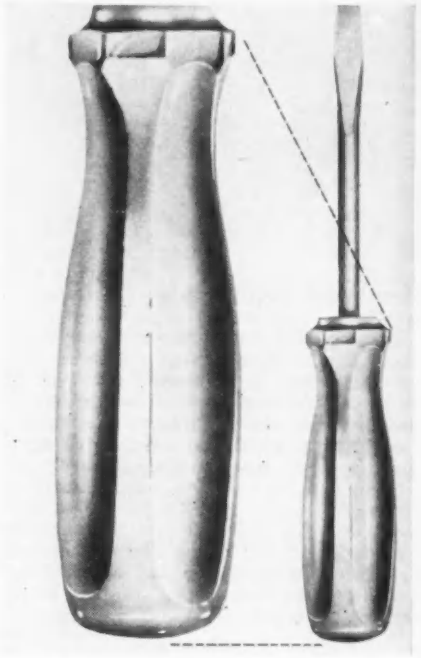
Natural Gas Equipment, Inc. has introduced the Wilgus-NGE Twin-Nozzle pilot regulator for installation on fluid or gas control regulators. This simplified regulator provides direct or reverse pilot action by changing the supply and diaphragm tubes from one position to another. A Bourdon tube, made of highly corrosive-resistant nickel alloy varies the flow of the pilot supply medium through a nozzle mounted in a twin nozzle block. This combination direct and reverse acting nozzle block is integral with the control setting mechanism. Pilot mechanism is sturdy and precision made throughout, yet is highly sensitive in action. This model can be installed on any type pressure regulator and two mounting assemblies are available.

Circle No. 20 on Postcard

Gas Scrubber

This gas scrubber which removes liquid and liquid mist from natural gas has proved successful on gas lift wells which formerly became inoperative due to foreign matter in the gas. The scrubbing element in this unit is of the coalescing type and contains ceramic tower packing which is so arranged that the gas must pass through the pack. Liquid mist in the gas well coalesce on the surface of the tower packing and this liquid will collect into drops large enough to gravitate down through the downcomer into the liquid sump from which it is drained. The scrubber can be drained manually or automatically and is available in any size and working pressure from the Oil Metering and Processing Equipment Corporation.

Circle No. 21 on Postcard



Plastic Handle Screwdriver

Adoption of a hand-shaped, non-rolling design for the plastic handles of all Proto screwdrivers and the addition of 13 new sizes have been announced by the Plomb Tool Company. The new handles have depressions for the thumb and forefinger to allow great downward pressure with little squeezing effort. Handles are molded with special alloy steel blades. An octagonal shape at the lower end of the handle, replacing the round design, also prevents rolling.

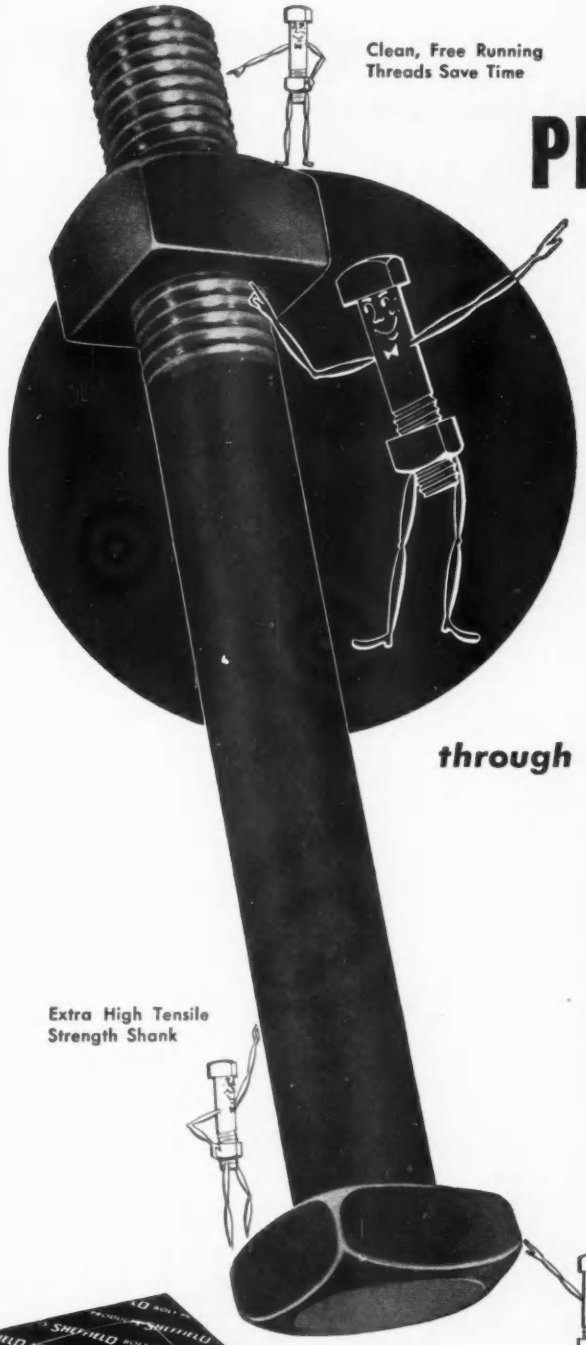
Circle No. 22 on Postcard

Industrial Enamel

A quick drying enamel is now distributed by Rex Industrial Paint Works for industrial and institutional use. The paint has been designed for successful use by unskilled painters on maintenance crews. A single coat will cover most surfaces, exclusive of new wood. It is applicable to glass, ceramic, wood and metal surfaces.

Circle No. 23 on Postcard

Save time! Keep informed! Circle numbers on postcard, page 275



Clean, Free Running Threads Save Time

PERFECT TEAMWORK

NUT-TO-BOLT FIT is a matter of close-tolerance precision in Sheffield Bolt and Nut manufacture. That's one reason why Sheffield Bolts give more gripping power; hold stronger, longer.

There IS a BIG DIFFERENCE *in bolts!*

It's STATISTICAL QUALITY CONTROL through Every Step of SHEFFIELD MANUFACTURE

HERE'S UNIFORMITY you can count on—quality you can be sure of—in every bolt, every carton, every shipment. Sheffield quality starts with special analysis steel, and it's rigidly checked and controlled right down the line to the finished product.

HERE'S HOW: Inspection data is recorded at every quality control step in manufacture. This data is analyzed by statistical methods similar to those used in aircraft production. Any deviation from Sheffield's high quality level shows up right now, and is corrected.

PACKAGE APPEAL: Not only for neat display, but for faster and easier identification of sizes and filling of orders, Sheffield's trim new carton is a stand-out. It's a real selling and handling help.

Extra High Tensile Strength Shank

Tough, Precision-Shaped Heads Defy Wrench Slippage

New Eye-Appeal, and Easy Order Filling with this SHEFFIELD HINGED-COVER CARTON

SHEFFIELD

Quality Starts with SHEFFIELD-Made Special Analysis Steel...

SHEFFIELD
STEEL
CORPORATION
HOUSTON KANSAS CITY
TULSA
SUBSIDIARY OF ARMCO STEEL CORPORATION

New Catalogs and Equipment Literature

Diesel Engine Primer

The P. H. Division of Harnischfeger Corporation has published a booklet on diesels written in non-technical language to show the simplicity of the modern diesel engine and its operation. The invention and early development is described and a comparison of the diesel engine with the gasoline engine is made.

Circle No. 24 on Postcard

Tygon Gasketing

A color bulletin giving the basic compositions and physical characteristics of Tygon gasketing is now available from U. S. Stoneware Company. Application of Tygon gasketing is described and advantages and disadvantages of Tygon compounds over other gasketing materials are presented.

Circle No. 25 on Postcard

Spiral Reamer

The new Rigoid 2-S spiral reamer reams pipe fast, makes quick work of increasing size of conduit box outlets, cuts holes in sheet metal smoothly and has reversible ratchet and capacity ⅛-inch to 2 inches. The reamer is described in a two-color bulletin recently released by The Ridge Tool Company.

Circle No. 26 on Postcard

Water Treating Plan

A complete water purification and treating service, chemical and mechanical, is described in a new bulletin published by Deady Chemical Company. Periodic analysis of individual water supply and plant conditions are made by the company's field service engineers and chemical products to meet the particular water conditioning problems are manufactured in the laboratories. The component parts of the Deady service are outlined in the brochure.

Circle No. 27 on Postcard

Pipelining Catalog

Allis-Chalmers Manufacturing Company has released a new catalog on pipelining showing the application of Allis-Chalmers equipment on every phase of this work. Various models of tractors and allied equipment are illustrated with specifications and working features of the equipment shown.

Circle No. 28 on Postcard

Centrifugal Pumps

Carver Pump Company has issued a bulletin on the small close-coupled, motor-driven centrifugal pumps, part of Carver's broad line of centrifugal pumps available in capacities up to 4000 gallons per minute and pressures up to 125 pounds. Referred to as model B, the pump is made in two sizes and will pump up to 70 GPM. It incorporates mechanical shaft seals, stainless steel shafts, enclosed bronze impellers and heavy duty ball bearings. The pump is designed for general service or as an integral part of air conditioning units, cooling towers and hot water circulators.

Circle No. 29 on Postcard

Control Center Book

A new booklet on control centers is available from the Westinghouse Electric Corporation. Three types of control centers are described and various electrical components making up typical units are illustrated. A three-step building block system of planning control centers is given along with check charts to aid the selection of the right control center arrangement. Reference tables for proper selection of starter size are provided.

Circle No. 30 on Postcard

Drill Pipe

A new bulletin on Spangweld drill pipe and Spang double-seal shrink thread drill pipe has been released by Spang-Chalfant Division of The National Supply Company. The Spangwelding process is described and recommendations for the use and care of Spangweld drill pipe and Spang drill pipe and tool joints are outlined.

Circle No. 31 on Postcard

Magnetic Motor Starters

Motor starters specifically designed for the petroleum, chemical and allied industries are described in a new folder published by Arrow-Hart & Hegeman Electric Co. Arrow-Hart produces the only size 5 motor starter that can be installed in a Crouse-Hinds' condulet. The folder shows how the sizes compare and illustrates the additional important advantages and features using pictures, diagrams and dimensions.

Circle No. 32 on Postcard

Diaphragm Motor Valves

The Honeywell series 100 diaphragm motor valve is described and illustrated in a new specification sheet which gives size, construction, body pressure range, connections and complete mounting dimensions.

Circle No. 33 on Postcard

Packaging Products

A booklet on packaging of products is now available from The J. B. Beaird Company. Manufacturers are told how to find a larger market for power units, process equipment and controls by having them completely packaged into composite products.

Circle No. 34 on Postcard

Diesel Engine Bulletin

Bulletin 5205 just released by The National Supply Company Engine Division describes the Lister Models FR4 and FR6, four-cycle stationary diesel engines. The four-page folder gives engine dimensions, weights and technical data on these 1000 to 1800 revolutions per minute, 36 brake horsepower to 54 bhp, 4 and 6-cylinder units. The FR engines have chrome-hardened cylinder liners, individual fuel-injection pumps for each cylinder and oversize crankshafts. High and low-compression ratios for easy starting and normal running are selected by spring-loaded levers.

Circle No. 35 on Postcard

Portable Heaters

Chinook Wind portable heaters, dryers and all purpose torches are described in a bulletin released by the International Manufacturing Company. Multiple uses for the Chinook Wind portable heater, the Little Chinook Wind, and the Chinook Wind torches are pointed out. Specifications and dimensions are given.

Circle No. 36 on Postcard

Flexible Metal Hose

A new two-color bulletin on Chicago Metal Hose flexible metal hose has been released by Flexonics Corporation. Emphasizing the wide range of hose types and assemblies available, the bulletin pictures some of the more common flexible hose installations and an application chart showing the type of CMH assembly to use for handling various kinds of liquids, gases, solids and semi-solids.

Circle No. 37 on Postcard

Save time! Keep informed! Circle numbers on postcard, page 275

News of Men in the Industry

Ben F. Curtis has been appointed chief geologist for Texas Eastern Production Corporation, Houston. Curtis, who joined Texas Eastern Production Corporation in 1951 as a district geologist, has recently served as division geologist in charge of the company's Shreveport division. Curtis was employed by Skelly Oil Company as assistant district geologist before joining Texas Eastern. Prior to that he held the position of district geologist for Kerr-McGee Oil Industries. Curtis will have headquarters in Houston.

Ben F. Curtis

•

Stanley B. Radack has been appointed district geologist for the Columbian Fuel Corporation with offices in Tulsa. Formerly Radack was connected with Great Lakes Carbon Corporation.

•

Donald M. Nace of the Research and Development department of Socony-Vacuum Oil Company, Inc., has received the company's 1953 Incentive Fellowship which allows the winner to seek higher academic degrees for a period not to exceed three years. Nace will work toward a Ph.D. in physical chemistry.

•

Hubert L. Popenoe has been appointed area geologist for Shell Oil Company in Los Angeles. Formerly district geologist in the company's coastal division at Ventura, Popenoe joined Shell as an assistant geologist in Los Angeles after his graduation from Pomona College, Claremont, Calif., in 1937. Since then Popenoe has served on the Bakersfield exploration staff. In his new position Popenoe will be concerned with exploration problems in California and the Pacific Northwest.

•

Lester Marshall, former geologist for the Devonian Company at Tulsa, has joined Warren Petroleum Corporation.

•

R. E. Clark, reservoir engineer for Shell Oil Company at Midland, Texas, has been assigned temporarily to The Hague.

•

R. E. Hayward, Gulf Oil Corporation, Tulsa, Okla., has been transferred to Oklahoma City as area geologist and **Otis R. Fenner** has been transferred from Oklahoma City to Tulsa. **Kirk Roberts**, who has been in the Rocky Mountain area for Gulf, has been transferred to the Oklahoma City geological staff.

•

Charles V. Campbell, Phillips Petroleum Company, has been transferred from Caracas, Venezuela, to the company's Geological department at Thermopolis, Wyo.

•

Guy E. Keith has resigned as drilling superintendent for The Carter Oil Company to become general field superintendent for Delta Drilling Company at Casper, Wyo.

Harry Rector, drilling superintendent of the southern district for Standard Oil Company of California, has retired after spending 46 years in the oil industry, 37 of these years with Standard of California. Rector began as a roustabout in the Orcutt Field when he was 17. After World War I he served 20 years in foreign service and in 1940 went to Sumatra as manager of the drilling operations. Rector returned to Kettleman Hills as drilling foreman, later was promoted to assistant drilling superintendent for the area and became drilling superintendent of the southern district in 1950.

•

Robert F. Matthews has been promoted to assistant division geologist for Continental Oil Company with headquarters in Midland. Matthews succeeds **C. S. Killgore**, regional manager of exploration, who has been promoted to division geologist at New Orleans, La. A native of Shreveport, Killgore has been associated with Continental's geological operations for the past six years.

•

C. A. Barton, Nance G. Creacer, A. J. Manulik and **F. L. Stead** have been promoted by Continental Oil Company to head newly created geological districts with the company's Midland, Texas, division.

•

Henry J. Grance has been appointed chief product engineer, Gasoline Section, of the Product Development and Product Engineering Department, Gulf Oil Corporation. Grance joined Gulf in 1946 as an engineer in the Aviation Section of the Gulf Research & Development Company and subsequently transferred to the engineering staff of the Automotive Division. Grance recently has been serving as assistant section head of the Automotive Fuels Section, Division of Automotive Engineering, at the research laboratories. He will be located in the company's general offices in Pittsburgh.

•

H. H. Hinson, Fort Worth, Texas, general manager of Continental Oil Company's southwestern region, has been elected vice president—exploration. Hinson will have headquarters in Houston, where he succeeds **Ira H. Cram**, recently named a senior vice president. From 1936 to 1948 Hinson was associated with the U. S. Bureau of Mines, Interior Department, at Amarillo, Texas. He joined Conoco in 1948 as chief production research engineer at Ponca City, Okla., and became assistant manager of the Production department with headquarters at Houston two years later. In 1952 Hinson was promoted to southwestern region general manager for Conoco with headquarters at Fort Worth.

H. H. Hinson

T. C. Stauffer has been appointed to the newly created post of administrative assistant, Production Department, Sun Oil Company. Stauffer moves to Sun's general offices from Evansville, Ind., where he has been manager of Sun's Central Production Division since 1941. **E. J. Reading**, Land department manager, Evansville, succeeds Stauffer and **James A. Veasey, Jr.**, leaseman, Evansville, has been named Land department manager. Stauffer joined the company in 1933 in Beaumont, Texas. Reading joined Sun Oil in 1935 as a landman at Evansville and became manager of the Land department in 1941. After receiving his M.S. degree in business administration from the University of Pennsylvania in 1937, Veasey joined Sun Oil the same year as a leaseman and served in that capacity until he succeeded Reading as Land department manager.

T. C. Stauffer

•

Harold T. Garvin and **Phil P. O'Neal**, Duncan, Okla., have formed the O'Neal-Garvin Drilling Company at Duncan.

•

John Cook, formerly assistant to Frank Willibrand, production manager of Sohio Petroleum Company, has been named manager of the company's industrial relations department at Oklahoma City. Other Sohio changes include **Jack H. Walters**, named district superintendent at Shreveport, La., succeeding **Henry J. DeLaune**, resigned; **Jim Morris** transferred from Shreveport to Lafayette as district geologist, succeeding **Jesse George**, transferred to Houston as division geologist.

•

J. K. Murphy, formerly chief geologist for the British-American Oil Producing Company, has been named chief geologist for Northern Plains Petroleum Company at Tulsa.

•

Lion Oil Company stockholders reelected the entire board of directors at the annual meeting in El Dorado, Ark., April 14. Officers of the board elected the same day were **T. H. Barton**, chairman; **T. M. Martin**, president; **A. F. Reed**, vice president; **J. E. Howell**, vice president; **R. E. Meinert**, vice president; **C. N. Barton**, vice president; **Jeff Davis**, secretary; **E. W. Atkinson**, treasurer; **E. P. Marrable**, assistant secretary and assistant treasurer; and **B. L. Allen**, assistant secretary.

•

Tyrus Mercer, maintenance foreman for the Clay City, Ill., area of Sohio Petroleum Company's operations, has been named district supervisor of the company's Magnolia, Ark., area. Mercer was employed by Sohio in 1939 and since then has worked as gauger, station engineer and head gauger. Before joining Sohio, Mercer was employed by Illinois Pipe Line Company and served three years in the U. S. Navy.

E. D. Ruse has resigned from the National Associated Petroleum Company, Tulsa, Okla., to enter business at Sterling, Colo., as a bulldozer contractor and consultant in drilling, completing and producing operations.

•

Lawrence W. Lee was named executive vice president and general manager of Husky Oil & Refining, Ltd. and elected to the board of directors of Husky Oil Company's principal subsidiary. Lee has been vice president and manager of refining and sales for the parent company and has been on leave of absence from the company to serve as director of marketing and distribution for Petroleum Administration for Defense in Washington, D. C., and later to attend the Advanced Management Training School of Harvard University. Joining Husky in 1941 as sales manager, Lee was made vice president and manager of refining and sales in 1948 and elected to the board of directors in 1950.

•

O. M. Evans, former vice president of drilling and production of Pacific Western Oil Corporation, has retired from the company's service and will go into business as an independent operator. Replacing Evans is **Carl H. Browall**, former Rocky Mountain division engineer, who has been general superintendent of drilling and production. Browall joined Cities Service Oil Company as a junior engineer in 1930 and later joined Lake Oil Company of Ada, Okla., serving as superintendent of the company for 12 years. Browall became associated with Pacific Western in 1948 in Lander, Wyo. In his new position Browall will have headquarters in Los Angeles.

Reese H. Tucker

J. A. Cleverley

Reese H. Tucker, manager of the Land-Geological division, and **J. A. Cleverley**, manager of Oil Production, have been elected vice presidents of Cities Service Oil Company (Del.). Cleverley also was elected a director of the company. Tucker was named to the board several months ago. Joining the company in 1930, Tucker was assigned to the Geological department, and advanced to manager of the Geophysical department, chief geologist, and manager. Cleverley has served in various executive capacities in the company's Oil Production division. He was transferred to Bartlesville in 1948 and later was appointed manager of the Oil Production division.

•

Robert L. Kidd of Bartlesville, Okla., was elected president of the newly-formed Arkansas Fuel Oil Corporation. Kidd has been in charge of the oil and gas exploration and production activities of the Cities Service Oil Company (Del.) and during the past five years has directed the exploration and drilling program of Cities Service in the major producing areas of the U. S. and Canada. Elected vice presidents of the new company were **H. T. Goss** and **J. A. Welch** of Shreveport and **Erle G. Christian** of New York. Goss and Welch were vice presidents of the predecessor, Arkansas Fuel Oil Company. **M. J. Lasseigne** and **John S. Sheffield** of Shreveport were elected treasurer and secretary.

Robert L. Kidd

•

Herman E. Nichols, Jr., has been named exploration manager for Warren-Bradshaw Exploration Company and **Robert W. Stroud**, formerly associated with Kirkpatrick Oil Company, Oklahoma City, is now Oklahoma district geologist for Warren-Bradshaw. Both have headquarters in Tulsa.

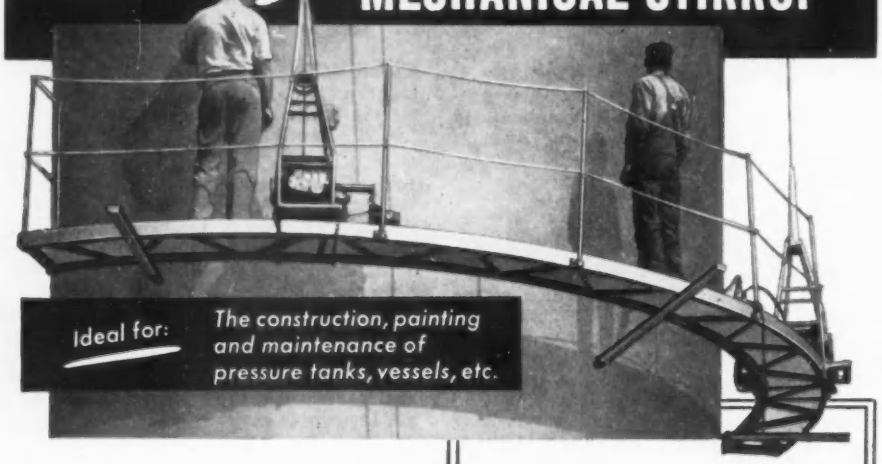
•

R. G. Holland has resigned as production superintendent for Stephens Petroleum Company to head the Production department of Fleet Drilling Company at Ada, Okla.

•

C. F. Elder, division petroleum engineer, has been promoted to assistant to division manager, Oklahoma Division of The Texas Company's Producing department, and **G. M. Bell** has been named to succeed Elder. In his new position Elder will be in division offices at Tulsa.

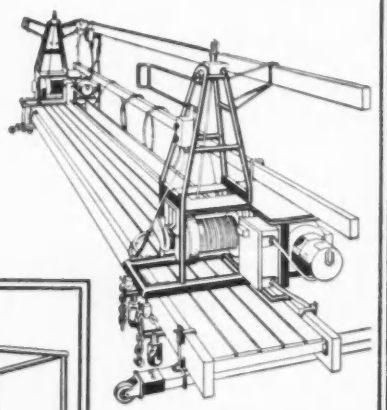
The New ALBINA Circular! MECHANICAL STIRRUP



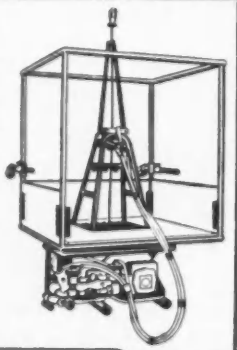
Ideal for: The construction, painting and maintenance of pressure tanks, vessels, etc.

ALUMINUM DIAMOND PLATE DECK PLATFORM

Platform as shown may be used as a 6, 16, 22 or 28-ft. swing stage. Platform consists of two 6-ft. and one 16-ft. sections. Can be used as a swing stage, single stirrup or basket. Air or electric operated.



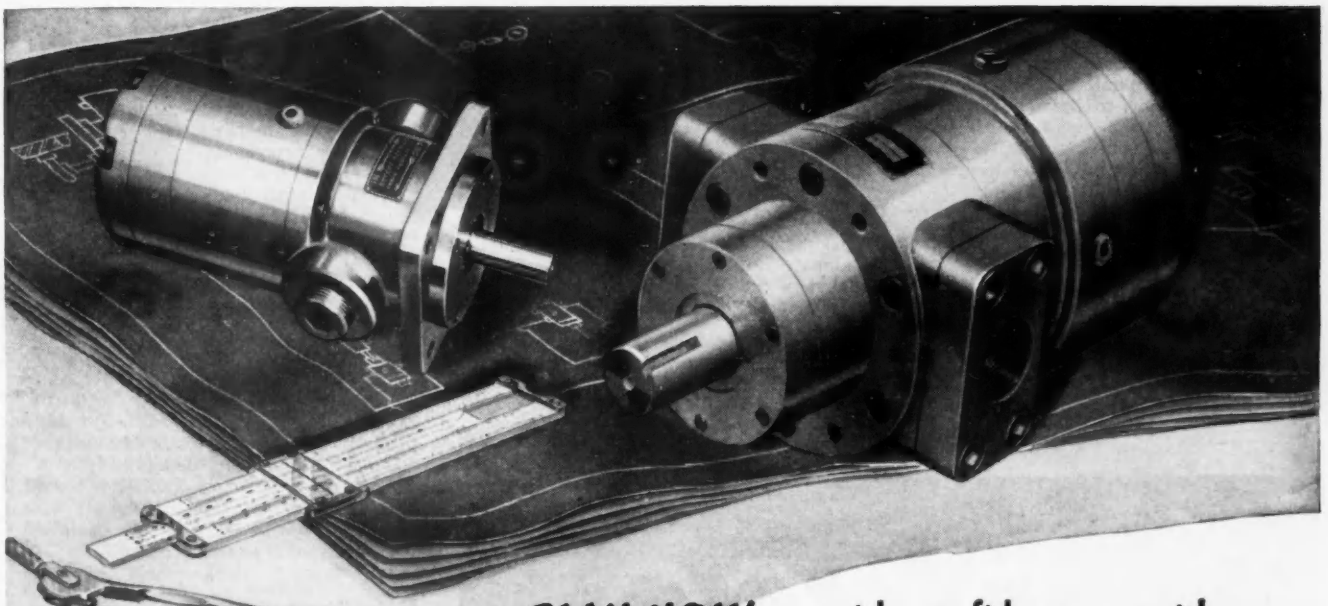
ALBINA MECHANICAL STIRRUPS are gaining in popularity by contractors across the nation. Workers like their safety features and convenience of rigging.



Safety Approved by State, Municipal, Corporation Safety Boards and Certified Engineers

Write for Complete Illustrated Catalog

ALBINA ENGINE & MACHINE WKS.
2100 N. Albina Ave. Portland, Oregon



PLAN NOW — with confidence — with

DENISON HydrOILic

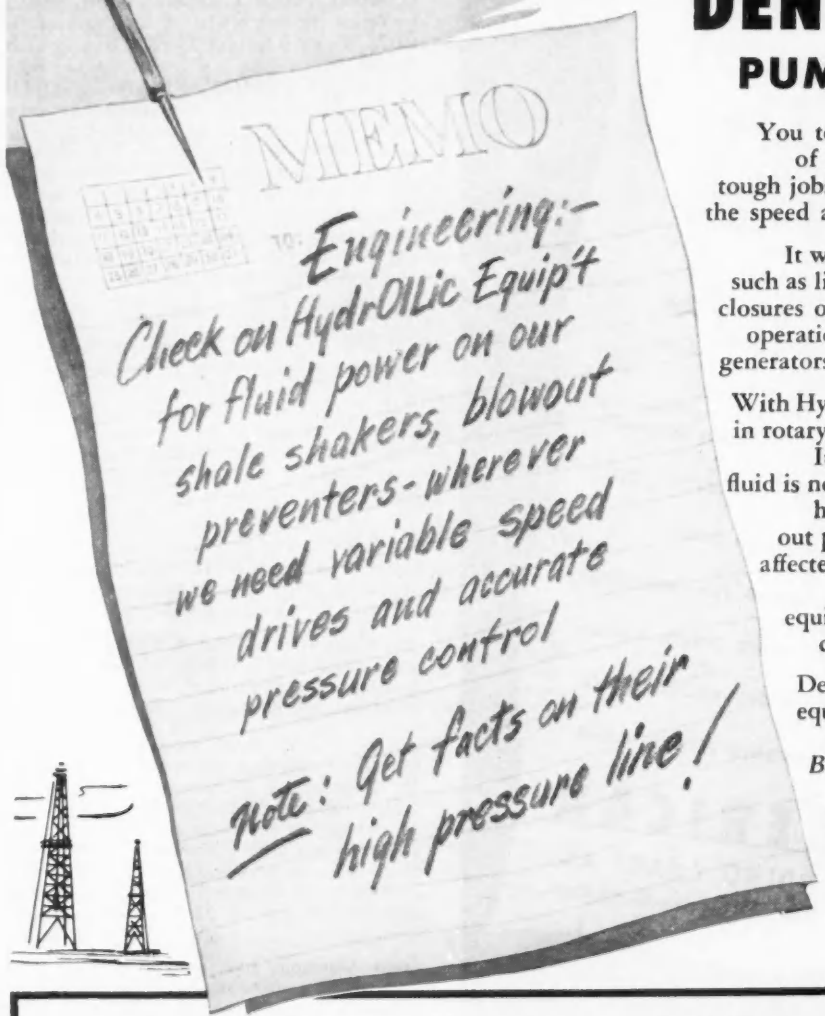
PUMPS and CONTROLS

You too can benefit from the dependable design of Denison HydrOILic Equipment — for those tough jobs where power and control are important to the speed and success of your oil field applications.

It will prove its advantages in applications such as lift and pull-down power for portable rigs . . . closures on blow-out preventers . . . bug-blower operation . . . drives for shale shakers, water pumps, generators, mud pumps, servicing equipment reels, etc.

With HydrOILics you can tap power already available in rotary rigs—no separate power source is needed. It cuts maintenance costs because hydraulic fluid is non-corrosive, non-abrasive. Existing blow-out hookups can be used without changes. Blow-out preventers won't freeze. Fluid motors are not affected by constant starting, stalling and reversing. Fluid action reduces wear and tear on equipment generally. Repair and replacement costs are lower than for other prime movers.

Denison offers an extensive line of hydraulic equipment for your hydraulic transmissions — for high speed or high power requirements. *Be sure you have the complete story.*

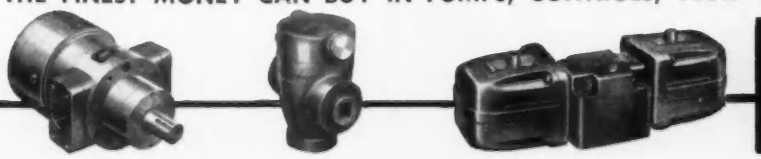

MEMO
To: Engineering:—
Check on HydrOILic Equip't for fluid power on our shale shakers, blowout preventers - wherever we need variable speed drives and accurate pressure control
Note: Get facts on their high pressure line!

The DENISON Engineering Co.

CHICAGO BRANCH: 4306 W. 63rd St., Chicago 29, Ill.
HOUSTON BRANCH: 1200 Bissonnet, Houston 5, Texas
WEST COAST BRANCH: 565 N. Prairie St., Hawthorne, Calif.

Factory and Home Offices
1204 Dublin Road, Columbus 16, Ohio

THE FINEST MONEY CAN BUY IN PUMPS, CONTROLS, FLUID MOTORS AND PUMPING UNITS



DENISON HydrOILics

Olen Lane, Los Angeles, Calif., assistant regional general manager of Continental Oil Company's western region, has been promoted to regional general manager. Lane will continue to have headquarters in Los Angeles, where he succeeds **C. R. Allen**, who is retiring. Lane has been associated with Continental for 33 years and has been active in the company's West Coast operations since 1923. He became regional manager of exploration in 1950 and later the same year was promoted to assistant regional general manager. Allen, 63, will continue to reside in California. He has been active in Continental Oil Company and associated companies, including Hudson's Bay Oil & Gas Company, Conoco's Canadian affiliate, since 1923. Allen held positions in production operations in Canada, Colorado, New Mexico, Illinois and Indiana before moving to Los Angeles in 1946 as division manager. In 1949 he was promoted to regional general manager.

•

Hillard W. Carey, who has been employed by Houston Natural Gas Corporation since 1943, has been transferred from Corpus Christi, Texas, to Houston as chief geologist for Houston Natural Gas Production Company, the new wholly owned subsidiary of the gas utility.

•

Charles E. Riddell has been named exploration manager for the northwest division, the British-American Oil Producing Company, with headquarters in Denver, Colo.

David H. Geary has joined the staff of Henson Drilling Company of Abilene, Texas. Formerly with Bethlehem Supply Company as machinery sales representative, Geary has been associated with Bethlehem for three years in Illinois and West Central Texas. Geary will remain in Abilene where the general office of Henson Drilling Company is located.

David H. Geary

•

John L. Medis, formerly assistant division superintendent of the Rocky Mountain Division of the Drilling department of Kerr-McGee Oil Industries, Inc., has been appointed superintendent of the division. Eddie A. Baxendale has been named assistant division superintendent.

•

H. R. Hamilton, president of the Huntington State Company, **J. W. Hancock**, president of Hancock Oil Company, and **S. Z. Natcher**, assistant to the vice president of Standard Oil of California, were elected to terms on the board of directors of the R. M. Pyles Boys and Girls Camp in California. The camp is a philanthropic project founded to assist underprivileged children and financed by contributions from petroleum industry personnel. Other oil men serving on the board are **S. F. Bowlby**, Shell Oil Company; **F. E. Fairfield**, Oil Tool Corporation; **J. E. Gosline**, Standard of California; **L. C. Graves**, Southwest Exploration Company; **R. H. Green**, Signal Oil and Gas Company; **J. M. Hillman**, Hillman-Kelley, Inc.; **L. L. Hillman**, Loren L. Hillman, Inc.; **F. Huntsinger**, Ventura Tool Company; **W. G. McComiskey**, Signal Hill Electric Company; **P. S. Magruder**, General Petroleum Corporation; **F. A. Morgan**, Richfield Oil Corporation; **G. C. Pilkington**, The Texas Company; **A. C. Rubel**, Union Oil Company; **R. C. Schweitzer**, Southwest Exploration Company, and **W. A. Smith**, W. A. Smith and Company.

•

R. J. Field has resigned from Deep Rock Oil Corporation to do geological consulting work in the Rocky Mountain area.

•

W. W. Heard, Jr., and **A. C. Gauthier, Jr.**, have organized Gauthier & Heard, petroleum engineering and consulting firm, with headquarters in Natchez, Miss.

•

Charles E. Phillips recently joined Robert W. Harrison & Company, consulting petroleum engineers and geologists, Houston, as petroleum reservoir engineer. For the past five years Phillips was with Standard Oil Company of Texas as senior reservoir and reserves engineer. Phillips is a graduate of Texas A. & M. College.

•

John Alderman has joined Adwin L. Cox, oil producer, as production engineer in the southern Oklahoma area. Alderman will be stationed at Healdton, Okla. Formerly he was associated with Atlantic Refining Company in the Sholem Alechem field.

•

Richard R. Crow has been appointed to the newly-created position of director of personnel development for Continental Oil Company with headquarters in Houston.

ARCCO
LIQUID GRAVITOMETER
NOW 5 MODELS
Indicating Transmitting Liquid Gravitometer
...for pipelines, gasoline and chemical plants, refineries, etc.
Ruggedly built for hard field use but with laboratory accuracy, the long accepted ARCCO-Anubis Liquid Gravitometer with all its splendid features is now available for recording, controlling, indicating, transmitting, or various combinations of these functions. Write us fully about your application and request Bulletin No. 111 Revised.
1. RECORDING LIQUID.
2. INDICATING TRANSMITTING.
3. INDICATING CONTROLLING.
4. RECORDING TRANSMITTING.
5. RECORDING CONTROLLING.
AMERICAN
RECORDING CHART CO.
3113 E. 11th St. • Los Angeles 23, Calif.
Send for Bulletin No. 111 Revised

Why Drill a Dry Hole?

PROVEN GEOPHYSICS

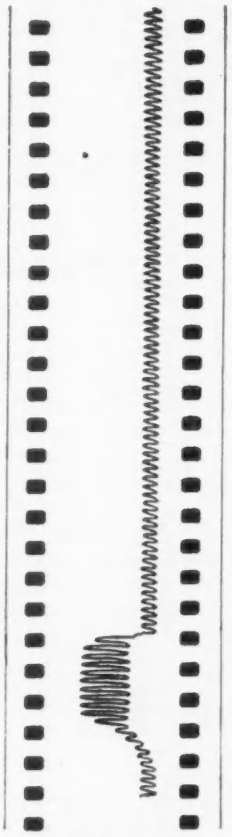
The Amazing Attractometer

The latest and most modern method of geophysical exploration that shortens the route to petroleum reserves by rigid instrumental recordings, indicating the existence or not of hydrocarbon accumulations, the approximate depth and quantity underlying the tested area; ten locations for a major oil company without error. Surveys conducted on acreage basis for cash fee and chance to earn small override, oil payment, leases or other interest, where saturation is indicated in commercial quantities. Full information on request.

To establish conclusive proof of the accuracy of our geophysical work, we will test and record on tape bearing your signature one or more wildcat locations in advance of drilling, indicating the existence or not of petroleum in commercial quantities underlying the tested areas and at what depth it may be found.

GEOPHYSICAL SURVEY SYNDICATE

4133 Sunnyslope,
Sherman Oaks, Calif.
Phone STate 46903



Specimen of tape indicating saturation

FOR SWABBING

AUTO-RELEASE WIRE LINE STRIPPER

Finest in the field. King Strippers represent outstanding advances in design and construction that assure long life and maximum operating efficiency:

- POSITIVE LATCH will not release by accident or surge of pressure.
- SURE RELEASE MECHANISM operated by rope socket striking bottom of the stripper.
- NON-SPARKING MATERIALS minimize fire hazard.
- ROLLER WIRE LINE GUIDES on hardened steel pins.
- SIDE OPENINGS for inserting packing while line is in the hole.
- PACKING IS SELF-CENTERING; compression screws need not be evenly adjusted.

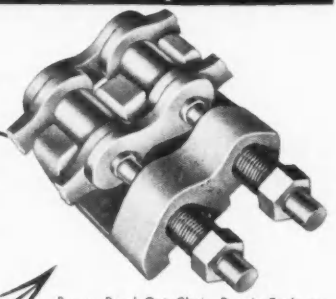
Export: R. S. STOKVIS & SONS
17 Battery Place, New York 4, N. Y.

KING OIL TOOLS

210 TERMINAL ST. HOUSTON 20, TEXAS OSage 3-3421

THE BOWEN PUNCH-OUT CHAIN REPAIR TOOL
PROVIDES THE
Fast, Safe, Economical Way to Repair Chain

The Bowen Punch-Out Chain Repair Tool, for use in dismantling or repairing single roller chains, is simple and positively foolproof.



ELIMINATES THE DANGER OF STEEL SPLINTERS INJURING WORKMEN

CUTS DOWN REPAIR AND DISMANTLING TIME

PREVENTS DAMAGE TO CHAIN THAT RESULTS FROM SLEDGING

Bowen Punch-Out Chain Repair Tools are engineered to withstand severe use and are economically priced.

THE TIME SAVED ON ONE APPLICATION WILL OFFSET THE COST

OPERATION—Merely place the roller chain in the Body of the Bowen Punch-Out Chain Repair Tool as indicated in the illustration. Tighten the Screws—this automatically centers the pins of the tool on the pins of the chain. Strike the heads of the pins sharply with a hammer—this will drive the pins forward and quickly and safely force the pins of the chain through the links.

The Bowen Punch-Out Chain Repair Tool is available for A.S.A. Roller Chains in pitches from ½-inch to 3-inch sizes and for API Roller Chains in 3-, 3⅛- and 4-inch sizes.

For further information write the S. R. Bowen Company, Santa Fe Springs, California

AVAILABLE THROUGH LEADING SUPPLY STORES

SR BOWEN CO

MAIN OFFICE AND PLANT:
11201 SOUTH NORWALK BOULEVARD
SANTA FE SPRINGS, CALIFORNIA
EXPORT OFFICE:
70 ROCKEFELLER PLAZA
NEW YORK CITY, NEW YORK

IN TULSA

and in the Oil Business—
It's both Pleasant and
Profitable to . . .

"Think... FIRST"

An Oil Bank . . . directed by Oil Men in the oil capitol of the World.

1st of Tulsa

THE FIRST NATIONAL BANK AND TRUST CO. OF TULSA

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Drew L. Hines, vice president, became Eastern operating head of the Tide Water Associated Oil Company as he assumed the duties of chairman of the Eastern Division Operating Committee and head of the Administrative department. Hines succeeds B. I. Graves, who retired. Hines has been associated with the firm and its predecessor, The Associated Oil Company, since 1922. In 1944 Hines became vice president of the Transportation and Supply department in New York.

Drew L. Hines

Daniel B. Lovejoy has been elected vice president and treasurer of Union Sulphur & Oil Corporation. A graduate of the Rice Institute in Houston, Lovejoy joined the company in 1938 at Sulphur Mines, La., and later transferred to the New York office where he served as secretary and treasurer. He returned to Houston in 1952 when the company's principal executive offices were established there.

•

Frank M. Wood, oil producer and drilling contractor of Wichita Falls, Texas, was elected a director of the Fort Worth National Bank. Wood is president of Frank Wood and Associates, Inc., and is a partner in the W & A Drilling Company. He is a director of the First National Bank of Wichita Falls and of the Texas Mid-Continent and the North Texas Oil & Gas associations.

Nelson H. James has been appointed to the position of manager of exploitation for Housh Drilling Company and other Housh interests. A graduate of The University of Texas, James worked for various drilling contractors and for Stanolind Oil & Gas Company for a year and a half followed by eight years as petroleum engineer for Stanolind. James joined Sohio Petroleum Company serving for eight years as district superintendent and as division superintendent in Houston. He was serving in the latter position at the time of his association with Housh.

Nelson H. James

Transfers and Promotions

Kerr-McGee Oil Industries, Inc., has announced that **Wayne Dean**, Gulf Coast Division superintendent for the company's Drilling department with headquarters in Oklahoma City. **W. F. (Bill) Baxter** fills the vacancy left by Dean. Succeeding Baxter as assistant Gulf Coast Division superintendent will be **M. C. Womack. George B. Kitchel**, general superintendent of the Drilling department, has been promoted to manager of Drilling department. Kerr-McGee Oil Industries, Inc., has acquired the services of **Paul Wolff**, naval architect and barge design engineer, and have named him manager of Marine Division of the Drilling department. Wolff's main headquarters will be at Morgan City, La.

•

Humble Oil & Refining Company announces the following changes in its Production department: **Olin C. Davison**, assistant superintendent, Houston Garage, named superintendent succeeding **Robert L. Shaw** who resigned; **Philip E. Barber**, who returned from military service, resumes duties as division civil engineer, East Texas Division; **C. C. Cox**, toolpusher in the London District, transferred to Friendswood District as toolpusher; **Ray L. Meadows**, toolpusher in the Vernon District, transferred to Friendswood District as toolpusher; **Virgil L. Garlington**, senior civil engineer, Gas Construction Division, Houston, moved to Mallalieu District as district civil engineer; **Garland Deaton**, toolpusher, North Katy District, transferred to Odessa District as toolpusher; **L. E. Cezeaux**, toolpusher, Odessa District, transferred to Avoca District.

•

Shell Oil Company has announced several changes in the New Orleans area staff. **W. H. Holleran**, former Production superintendent in Shell's Franklin division, is now manager of the company's Donaldsonville Production division replacing **H. F. Winham**, now manager of Shell's New Orleans Oil Shipping division. Heading up a newly created Production division for the area with offices in Westwego is **W. E. Harpst**, former chief mechanical engineer in the Houston and New Orleans areas. **A. J. Clark** has been named Purchasing-Stores department manager for Shell in New Orleans, following the appointment of **R. F. Martin**, former manager, to the post of Purchasing-Stores manager in Shell's newly created Rocky Mountain area in Denver.

Because of improved hardness, toughness and abrasion resistance . . .

Operators Specify Diamond Metal for all hard facing

Here is a field-proven way to get more wear out of your subsurface equipment:

Face it! . . . with Diamond Metal—tough, pure tungsten carbide that has the general properties of diamond.

Tool joints, drill collars, drilling bits, cutting tools, fishing tools, rotary shoes . . . will double and triple their down hole life, for faster operations and greater profits.

Because Diamond Metal applies evenly, does not "float," and will not chip or break down, you can be sure of an even protective coat that will really "take it" when the going gets rough.

Tough-hard Diamond Metal is recommended for every equipment surface receiving abrasion, stress, shock or impact.

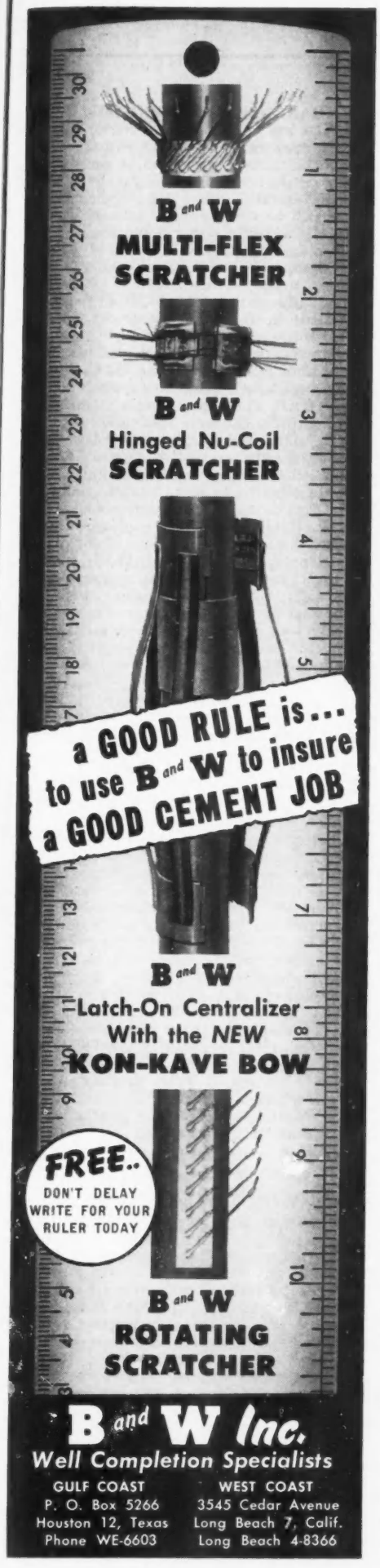
Next time your tools are in the shop, take the extra precaution to *specify* Diamond Metal. Don't leave it to chance.

Ask for full particulars and field results involving thousands of operations throughout the oil country.

DIAMOND METAL COMPANY
DIAMOND
6945 CANAL ST.
HOUSTON, TEXAS

P. O. BOX 1122 HOUSTON, TEXAS

3874



DEATHS

Marrs McLean, 69, oilman and political leader, died May 18 in San Antonio, Texas. A supporter of Sen. Robert A. Taft in the last election campaign, McLean was vice chairman of the National Republican Finance Committee. McLean entered the oil business in 1907 at Spindletop and was responsible for the tremendous production of oil from salt dome flanks along the Gulf Coast.

•

Elmer (Trim) Capshaw, chief engineer for the Oklahoma Conservation Commission, died April 13 at his home at Norman, Okla. Capshaw had been with the commission since 1933.

•

Fred T. Hildt, 71, independent oil man, died April 14 at his home in Tulsa. Hildt had been with Gypsy Oil Company and was purchasing agent for The Carter Oil Company before organizing the Investors Royalty Company, Inc.

•

C. M. Roberts, 46, field drilling and production superintendent for the United Gas companies, Union Producing Company and United Gas Pipe Line Company, died at Minden, La., April 3. Roberts had more than 22 years of continuous service with the United Gas companies.

•

William L. Love, president of the Petroleum Engineer Publishing Company, died at his home in Dallas May 10. Love was with the company since its organization in 1929 and served as advertising manager before becoming president of the company. Formerly Love was with The Oil and Gas Journal in Tulsa.

•

George E. Burton, 72, consulting petroleum geologist, died March 30 at Seguin, Texas. Burton entered the oil industry in 1915 when he joined the Oklahoma Geological Survey. In 1951 he was retired as a geologist from Sun Oil Company. At the time of his death Burton was doing consulting work at Gainesville, Texas.

•

F. R. (Bob) Bodien, 55, head of Shell Oil Company's Centralia, Ill., office, died April 11.

•

Willard M. Hall, former director and member of the management committee of Creole Petroleum Corporation, died April 8 at his home at Winter Park, Fla. Hall was associated with Creole Petroleum and other affiliates of Standard Oil Company (New Jersey) for more than 30 years. He retired from the company in May, 1951.

•

Russel L. Vernor, manager of The Pure Oil Company's Beaumont Marine Division, died April 17 in Beaumont, Texas. Vernor had been with Pure Oil for more than 36 years. Before joining the Transportation Division, he had been superintendent of Pure Oil's Smiths Bluff Refinery at Nederland, Texas.

•

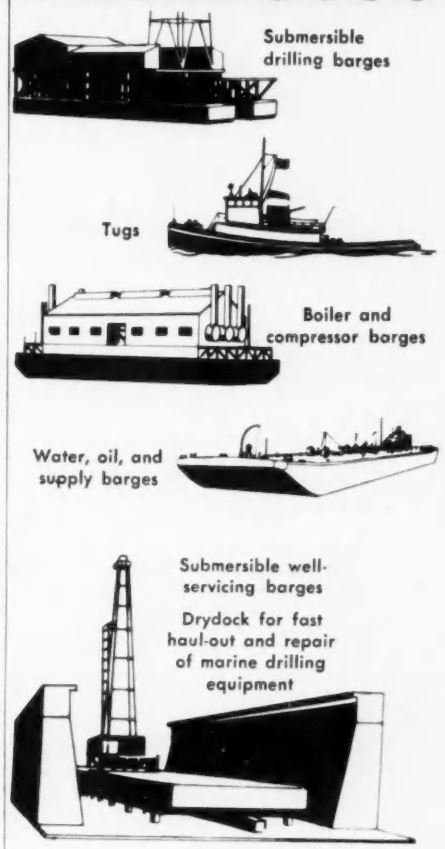
John Henry Lang, 72, retired oil well drilling contractor, died April 16 at his home in Tulsa, Okla.

•

Fred R. Smith, 70, retired Production department superintendent for Gulf Oil Corporation, died April 27 at his home in Tulsa. Smith retired in 1948 after 40 years with Gulf and its predecessor, Gypsy Oil Company.

Levingston

BUILDS FINE SPECIALIZED MARINE EQUIPMENT FOR THE PETROLEUM INDUSTRY


Submersible drilling barges
Tugs
Boiler and compressor barges
Water, oil, and supply barges
Submersible well-servicing barges
Drydock for fast haul-out and repair of marine drilling equipment

Levingston is not only located conveniently with respect to marine drilling operations on the Gulf Coast, but here you will find marine engineers and constructors who understand the language of oil operators. Bring your marine petroleum equipment problems to Levingston *first* for a quick economical solution.

Levingston
SHIPBUILDING CO.
Orange, Texas

Companies in the News

New Stanolind Oil and Gas Company Research Center

The main office and laboratory building of the new Stanolind Oil and Gas Company research center is shown as it is seen from the roof of the pilot plant. Located on an 80-acre plot in Tulsa, the center will be completed and occupied this summer. The three-story section is the laboratory and the two-story section extending south from the main building houses the cafeteria and garage.

SUNRAY OIL CORPORATION has realigned executive responsibility in its Exploitation (Drilling and Producing) department. Personnel changes include **J. R. Vandever,** formerly Exploitation department general superintendent, named to manager of joint operations for Sunray; **John H. Douma** and **C. J. Kerwin,** formerly assistant general superintendents in the Exploitation department, named southern division superintendent and northern division superintendent in charge of the development, drilling and engineering activities within those divisions. Other departmental personnel changes include the appointment of **M. S. Patton, Jr.** as development advisor of the department and **J. F. Adkisson, Jr.** as technical advisor. Sunray also has announced a new department of Industrial Relations to be headed by **Forney Hutchinson, Jr. R. Alvin Summers,** formerly superintendent of the company's Oklahoma exploitation district has been transferred to the Tulsa general offices as supervisor of the new department's safety and training section and to assist field supervisors in employe relations. **V. L. Smith,** formerly assistant Oklahoma district superintendent at Oklahoma City has been named superintendent of the Oklahoma district.

•

SHELL OIL COMPANY has announced the formation of a new Oil Shipping Division to handle the increasing amount of crude oil produced in Shell's New Orleans area. The new division, a part of the Company's Production department, will be headed by H. F. Winham, former Production Division manager at Donaldsonville. Headquartered in New Orleans, the new division will handle all construction, operation, gauging and maintenance for gathering systems, terminals and other facilities. Other personnel appointments in the new division are G. H. Starrett, division superintendent; S. G. Wiles, division mechanical engineer; and A. L. Bradley, head of the administrative section.

•

STANOLIND OIL AND GAS COMPANY has established a new district production office in Roswell, N. M. The Roswell staff will be in charge of operations in New Mexico, Arizona and 11 counties in southern Colorado. These operations formerly were handled from Lubbock. The Roswell production staff will be in addition to the exploration district office which Stanolind established in July, 1951. **C. L. Kelley,** formerly in Brownfield, Texas, will be district superintendent; **E. M. Knight** will be district engineer; and **M. S. House,** district clerk. Other transfers are **W. A. Kimbrough,** from Tulsa to Brownfield to replace Kelly as field superintendent; and **R. H. Lee Davis** to succeed House as field clerk in the North Cowden area. **C. E. McBurnetter** will be the new field clerk at Wink.

•

STANDARD OIL COMPANY OF CALIFORNIA has announced that unit operation of the Kettleman Hills North Dome oil field became effective April 1. Under terms of a unit agreement, Standard will operate all the properties in the area for the participating companies. The unitization will permit more efficient over-all operation, yielding maximum ultimate recovery of oil, gas and associated hydrocarbons. In taking over the unit, Standard has offered employment to 164 persons formerly employed by the Kettleman North Dome Association.

•

VICKERS PETROLEUM COMPANY, INC., has announced the formation of Vickers Explorations Ltd., a partnership operation originated for the purpose of drilling and producing oil and gas properties in Texas, New Mexico, Oklahoma and Kansas. The new enterprise began drilling its first test well in March in the Purdy sector of Garvin County, Oklahoma.

•

SHELL OIL COMPANY has announced plans for a new exploration and production organization embracing North Dakota, South Dakota, Montana, eastern Wyoming and eastern Colorado. The administrative group is expected to be in full operation by January 1, 1954, with headquarters in Denver. **W. A. Alexander,** vice president in charge of Shell's Tulsa area, will head the new office as vice president in charge of the Rocky Mountain area. Shell's division offices at Casper, Wyo., and Denver will continue to operate but will report to Denver instead of to the Los Angeles or Tulsa offices.

STANDARD OIL COMPANY OF CALIFORNIA has announced the consolidation of its former Producing and Natural Gasoline departments into a single new Producing department. Management of the former Natural Gasoline department in the future will be designated as follows: **H. J. Maxwell,** assistant general manager, gasoline plant operations; **G. C. McLaren** general superintendent, gasoline plant operations, southern district; **H. V. Cowger,** general superintendent of gasoline plant operations in the Taft area; and **G. L. Ross,** general superintendent of gasoline plant operations in the Kettleman-Coalina area. Other positions include **H. C. Fashbaugh,** assistant manager-accounting division; **R. R. Auchmuty,** assistant maintenance superintendent, Taft area; **F. L. Bowen,** superintendent-gasoline plant operations, Kettleman-Coalinga area; **R. F. Childs,** chief process engineer-natural gasoline division; **K. Eichler,** assistant maintenance superintendent, Kettleman-Coalinga area; **E. E. Gialdini,** senior engineer; **C. B. Heartwell,** superintendent-gasoline plant operations, southern district; **D. B. Johns,** technical supervisor-natural gasoline division; **G. C. Kuhns,** assistant maintenance superintendent, southern district; **R. S. Ridgeway,** mechanical supervisor; **L. H. Vane,** senior contract man; and **W. H. Whimpey,** superintendent-gasoline plant operations, Taft area.

•

HOUSTON NATURAL GAS CORPORATION has announced the formation and chartering of the Houston Natural Gas Production Company as a wholly-owned subsidiary of the gas utility. The Houston Natural Gas Production Company proposes to undertake a program of general exploration including active participation in oil and gas development as well as the acquisition of substantial gas reserves. **Dr. Byron B. Boatright,** consulting petroleum and natural gas engineer, has been elected vice president and general manager of the production company with headquarters in Houston. Formerly Boatright was at Austin, Texas, serving as consultant for more than 40 major oil and gas companies, banks and independent firms. Other officers named are **Frank C. Smith,** president; **J. H. Wimberly,** executive vice president; **John B. Cookenboo,** treasurer; and **Kenneth Fellows,** secretary, all of Houston. Directors are Smith, Wimberly, Boatright, Cookenboo, and **Joseph F. Wolff** of Corpus Christi.

•

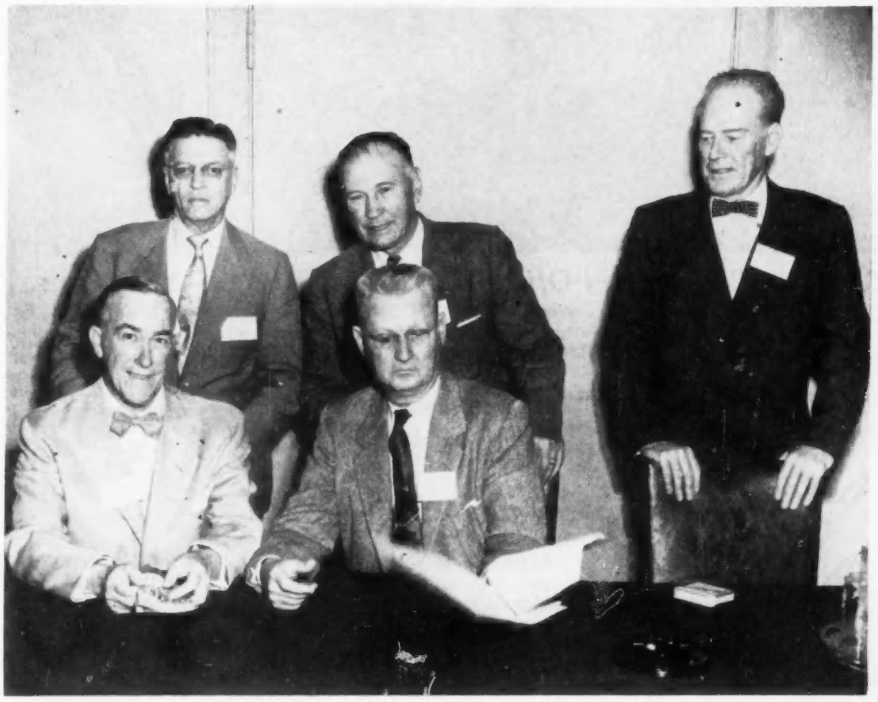
SUNRAY OIL CORPORATION has announced that field operations of the company's gas-gasoline division, formerly under supervision of the company's Manufacturing, Sales and Pipe Line department, has been transferred to Sunray's Exploitation department. **E. J. (Ernie) Mills,** who has been manager of the company's gas-gasoline division, will continue in charge of these operations now assigned to the Exploitation department which combines all field operations including drilling and oil and gas production. Sunray's Manufacturing, Sales and Pipe Line department with **H. W. Manley** as vice president, will continue to handle the negotiation of all gas sales contracts, the sale and distribution of all gas-gasoline plant products, all new projects including engineering evaluations, development, process design and construction.

Carl A. Young Honored By API Production Division

Carl A. Young of Dallas, Texas, director of the API Division of Production, was elected an honorary member of the Eastern District's advisory committee at the spring meeting held in Pittsburgh, Penn. Young will retire on July 1 after 29 years of service in this capacity with the API.

New chairman of the Eastern District elected at the meeting is R. L. Bird, Jr. of Columbian Carbon Company, Charleston, W. Va. Seven vice chairmen elected include Paul G. Benedum, Hiawatha Oil Co., Pittsburgh; Harry Brown, Chartiers Oil Co., Pittsburgh; J. F. Buckwalter, Ryder-Scott Co., Bradford, Penn.; Jack Cashell, The Preston Oil Co., Columbus, Ohio; J. Robert Horner, Delaware Gas Co., Clarksburg, W. Va.; Fred C. Newman, Old National Bank, Evansville, Ind.; and Douglas Rogers, South Penn Oil Co., Bradford, Penn.

The newly-elected secretary-treasurer is R. J. Murdy, New York State Natural Gas Co., Pittsburgh, and John T. Galey, independent producer of Pittsburgh and chairman of the Eastern District during the past year, was named chairman of the Advisory Committee.



TIPRO's New Officers

New officers elected at the seventh annual meeting of the Texas Independent Producers and Royalty Owners Association in San Antonio include William T. Beard, Jr., San Antonio, treasurer, seated left; and M. D. Bryant, San Angelo, president, seated right. Standing are E. I. Thompson, Austin, executive vice president; Bryan W. Payne, Tyler, vice chairman, and Bert Fields, Dallas, secretary.

Petroleum Production Group Announces Committee Chairmen

B. H. Anderson, Continental Oil Company, Los Angeles, president of Petroleum Production Pioneers, has announced the appointment of committee chairmen for the year 1953.

These chairmen include Roy W. Johnson, Republic Supply Company of California, entertainment committee; M. O. Johnston, retired, Johnston Testers, Inc., administrator of memorial fund; C. T. Reichert, National Supply Company, arrangements; A. C. Rubel, Union Oil Company, nominating; Tom W. Selser, retired, Macco Corporation, welfare; J. J. Siegel, Kobe, Inc., membership; Paul Terry, Capital Company, finance and housing; G. M. Wilson, World Oil, publicity.

Fletcher Elected President Of AIME at Los Angeles

Andrew Fletcher, president of St. Joseph Lead Company, was elected president of the AIME at the annual meeting held in Los Angeles. Fletcher has served as director, treasurer and vice president of the AIME.

Andrew Fletcher

Awards for "distinguished contributions" in the fields of petroleum geology, petroleum engineering and geophysics included the Charles F. Rand Medal presented to Eugene Holman, president of Standard Oil Company (N. J.), and the Anthony F. Lucas medal awarded to Morris Muskat, technical assistant to the vice president of production, Gulf Oil Corporation, Pittsburgh.

National Petroleum Council Names Oil and Gas Committee

The National Petroleum Council chairman, Walter S. Hallanan, announced the appointment of a committee on oil and gas exploratory and development requirements to study the minimum requirements of manpower, equipment and materials for all phases of oil and gas exploration and development.

The membership of the committee, of which Paul Endacott, president of Phillips Petroleum Company, Bartlesville, Okla., is chairman, is composed of the following: Hines H. Baker, Humble Oil & Refining Company, Houston; F. W. Brigance, American Association of Oilwell Drilling Contractors, Fort Worth; Russell B. Brown, Independent Petroleum Association of America, Washington, D. C.; J. P. Coleman, National Stripper Well Association, Wichita Falls, Texas; Robert H. Colley, The Atlantic Refining Company, Philadelphia; Stuart M. Crocker, The Columbia Gas System, Inc., New York; E. DeGolyer, DeGolyer and MacNaughton, Dallas; J. C. Donnell, II, The Ohio Oil Company, Findlay, Ohio; Stark Fox, Oil Producers Agency of California, Los Angeles; Hial B. Gernert, Rocky Mountain Oil and Gas Association, Casper, Wyo.; George J. Hanks, South Penn Oil Company, Bradford, Penn.; A. Jacobsen, Amerada Petroleum Corporation, New York; Mason B. Jones, Petroleum Equipment Suppliers Association, Toledo; Paul Kayser, El Paso Natural Gas Company, El Paso; Richard Gray Lawton, Lawton Oil Corporation, Magnolia, Ark.; J. Sayles Leach, The Texas Company, New York; Charlton H. Lyons, Shreveport, La.; L. F. McCollum, Continental Oil Company, Houston; R. W. McDowell, Mid-Continent Petroleum Corporation, Tulsa; N. C. McGowen, United Gas Corporation, Shreveport; Bryan W. Payne, Texas Independent Producers and Royalty Owners Association, Tyler, Texas; William T. Payne, Mid-Continent Oil & Gas Association, Oklahoma City; Frank M. Porter, American Petroleum Institute, New York; J. French Robinson, Consolidated Natural Gas Company, New York; Reese H. Taylor, Union Oil Company of California, Los Angeles; W. W. Vandeveer, Cleveland; John H. White, Hewitt Oil Company, Charleston, S. C.; and C. H. Wright, Sunray Oil Corporation, Tulsa.

Los Angeles API Chapter Elects Officers for 1953

Ted Ledbetter, division drilling and production superintendent, The Union Oil Company, California has been elected chairman of the Los Angeles Basin Chapter of the API for 1953.

Other officers named are Marshall C. Turner, Continental Consolidated Corporation, vice chairman; Herman Schaller, McCullough Tool Company, secretary-treasurer; Dean R. Hoffman, Lane-Wells Company, assistant secretary-treasurer; W. R. Wiley, McCullough Tool, program chairman; Verde E. Boyer, Sargent Engineering Corporation, refreshment chairman; G. C. Hepburn, Jr., Schlumberger Well Surveying Corporation, public relations chairman and Frank Webb, Lane-Wells Company, arrangements chairman.

Seminole Chapter API Officers

Newly elected officers of the Seminole, Okla., API Chapter, are, left to right, Walter E. Bailey, third vice chairman; Jesse T. Nutter, fourth vice chairman; James R. Marty, chairman; L. Allan Brandon, second vice chairman; Bill Lohman, first vice chairman, and W. R. Bell, secretary-treasurer.

YOUR U. S. A.

Many windy politicians have been screaming that the people—you and I—are to blame for all the ills that have befallen America. We're responsible, they say, for inflation; high prices; extravagance in government; our bungling foreign policy; disarmament; the war in Korea; the ammunition shortage, and our vulnerability to A-bomb attack. Some of them shout for price controls; a wage freeze; rationing and a lot of other silly things to punish us and bring us to our senses.

Many of these vociferous gentlemen have sat in the House or Senate like little mice, through ten to twenty years of unprecedented government waste, debauchery and gross mismanagement, too frightened, too ignorant, or maybe too satisfied to open their mouths.

It would be a good idea if fifty or sixty million of us guilty sabateurs would drop them a line to let them know that **WE KNOW** just where the blame belongs—then render a verdict the next time we go to the polls.

SPANG WELDLESS JARS

Spang Drilling and Fishing Jars, each made from a single piece of highest-quality alloy steel by drop and hammer forging and then heat-treated for utmost serviceability and safety, have proved their practical advantages for years, in comparison with jars of the welded type.

Spang Weldless Jars are known throughout the world, and are preferred wherever cable-tool drilling is done. While they cost more to buy, they are economical to use because of lower footage cost and less time lost in fishing and replacement. Standard stroke lengths, diameters, and joint sizes are readily available at field stores.

PETROLEUM EQUIPMENT SUPPLIERS' ASSOCIATION

SPANG **CABLE TOOLS** made by SPANG & CO., BUTLER, P.A.

The HIGHER STANDARD

for OIL WELLS • GAS WELLS • ARTESIAN WELLS
SHOT BLAST HOLES • PROSPECT DRILLING

SPECIFY SPANG—FOR SALE BY DEALERS EVERYWHERE

Illinois Oil and Gas Club Announces New Officers

New officers of the Illinois Oil and Gas Association for 1953 were elected at the eighth annual meeting in Mt. Vernon, Ill. V. J. Nolan, independent producer, Mt. Vernon, is the new president.

Other officers are M. H. Plummer, The Pure Oil Company, Olney, Ill., first vice president; D. R. Stewart, Moses & Stewart, Mattoon, Ill., second vice president; E. J. Reading, Sun Oil Company, Evansville, Ind., third vice president; E. A. Davenport, Shell Oil Company, Centralia, Ill., secretary; C. R. Collins, Collins Bros. Oil Co., Mt. Vernon, Ill., treasurer; C. T. Smith, independent producer, Flora, Ill., general counsel; and Charles J. Pardee, Mt. Vernon, Ill., executive secretary.

AGA Names Otto Head Of Convention Committee

Robert W. Otto, president of Laclede Gas Company, St. Louis, has been appointed chairman of the general convention committee of the American Gas Association.

The thirty-fifth annual convention of AGA is planned for October 26-28 in St. Louis. Industry executives who will assist Otto in financing, housing and arrangements for the general session programs and other convention events include Eskil I. Bjork, The Peoples Gas Light and Coke Company, Chicago; Lyle C. Harvey, Affiliated Gas Equipment, Inc., Cleveland; J. T. Innis, Northern Natural Gas Company, Omaha; F. A. Lydecker, Public Service Electric & Gas Company, Newark, N. J.; and James S. Moulton, Pacific Gas & Electric Company, San Francisco.

Hotel reservations will be handled by a housing bureau. Members are urged to send applications for reservations as soon as possible to the Hotels Convention Bureau, American Gas Association, Room 405, 911 Locust Street, St. Louis 1, Mo.

Oilwell Drilling Contractors Have Discussion on Jet Bits

Jet bits for oilfield drilling, their design, production and application were discussed by a panel of six engineers and drilling superintendents at a meeting of the Fort Worth-Dallas Chapter of American Association of Oilwell Drilling Contractors recently in Fort Worth.

Participating in the panel were Harold Nolley, Hughes Tool Company, Houston; W. E. Scarborough, Reed Roller Bit Company, Houston; George Cannon, Humble Oil & Refining Company, Houston; John Rheas, Southeastern Drilling Company, Dallas; J. D. Poe, Loffland Brothers Company, Odessa, and A. B. McLemore, Holmes Drilling Company, Houston. Gilbert Rowe, Rowan Drilling Company, Fort Worth, was moderator.

Bryan Is Information Director Of Independent Oil Group

Lyman L. Bryan has been named director of information of the Independent Petroleum Association of America with offices in Washington, D. C. A graduate of the University of Oklahoma, Bryan formerly was with the Landsay, Okla., Chamber of Commerce, the Pan American Refining Corporation, Texas City; and the National Cotton Council, Memphis, Tenn.

YOUR ANSWER TO MUD CONTROL...

OILFOS . . . water-soluble glassy phosphate

TSPP . . . tetrasodium pyrophosphate

STP . . . sodium tripolyphosphate

SAPP . . . sodium acid pyrophosphate

Monsanto—world's largest manufacturer of elemental phosphorus—makes one of the most complete lines of phosphates for mud control. Your favorite supplier stocks these compounds. He knows from experience they are best sellers because they are best performers.

To put these proved Monsanto phosphates to work for you, see your supplier, or write for more information to MONSANTO CHEMICAL COMPANY, Phosphate Division, 1700 South Second Street, St. Louis 4, Missouri.

THIS COMPLETE LINE OF MONSANTO PHOSPHATES

DISTRICT SALES OFFICES: Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle, Twin Cities. In Canada, Monsanto Canada Limited, Montreal.

MONSANTO
CHEMICALS — PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

OIIC Representative Named For Gulf-Southwest District

Earl W. Grabhorn has been appointed district representative of the Oil Industry Information Committee in the Gulf-Southwest District to fill the vacancy created by the promotion of W. T. Lynde last year to senior representative for the district embracing Texas, New Mexico, Louisiana, Mississippi, Alabama and Arkansas.

Grabhorn becomes the second district representative in the Dallas OIIC office which services the OICC program in Texas and New Mexico. Grabhorn was president of the New Mexico Audio-Visual Association and director of the Audio-Visual Department of the National Education Association at the time of his OIIC appointment.

Field Conference to Be Held In September in Montana

The Billings Geological Society of Billings, Mont., will hold its fourth annual field conference during early September in the Little Rocky Mountain area of north central Montana. Headquarters and registration will take place at Zortman, Mont.

Because of inadequate housing facilities, the society plans to establish a field camp near Zortman and is encouraging registration of men only, with participation limited to 200. Paul McGovney, geologist for Honolulu Oil Corporation, Billings, is general chairman. Persons desiring to obtain registration blanks are urged to write to J. L. Cramer, Stanolind Oil and Gas Company, 526 Securities Building, Billings, Mont.

AIME Awards Presented

Harry Vaughn, Lane-Wells sales engineer, representing the Southwest Texas Section of the AIME, accepts the president's banner and the gavel awards from Michael L. Haider, retiring national president, at the institute's national meeting. The banner award was presented to the local section for submitting the greatest number of membership applications in proportion to its regular membership. The special prize gavel was awarded to the section obtaining the largest total number of applications for membership.

Program Chairman Named For Desk and Derrick Clubs

Mrs. Bettie Conley, New Orleans, has been named program chairman of the Association of Desk and Derrick Clubs of North America for 1953. Members of the committee are Miss Murrel Straley, Louisville, and Miss Bette J. Scott, Amarillo.

The committee will furnish information on the petroleum industry to any Desk and Derrick club requesting it. Requests should be directed to Mrs. Conley, Estate of William G. Helis, 912 Whitney Building, New Orleans.

Wyoming Geological Association Plans Annual Field Conference

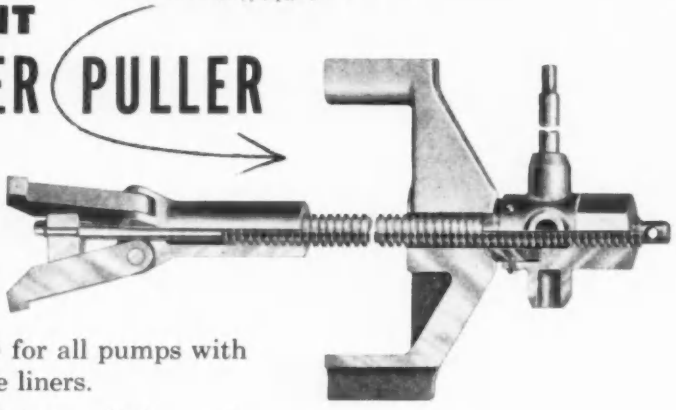
The Wyoming Geological Association will hold its eighth annual field conference at Laramie, Wyo., and vicinity July 30-August 1. The University of Wyoming will serve as host and make available its facilities for conference purposes. Drs. S. H. Knight and Horace D. Thomas of the University are general chairmen. Daily field trips will be conducted in the Laramie Basin of Wyoming and the North Park Basin of Colorado.

Registration will be held on the campus the afternoon of July 29. The geomorphology of the Medicine Bow Mountain Range, the structural relations of the Medicine Bow Mountains to the Laramie Basin and the sedimentary structures of the Fountain and Casper formations of the southern Laramie Basin will be studied in the field on the first day. The second day will be devoted to oil fields and the last day's program will be concerned with the structure and stratigraphy of the North Park Basin in northcentral Colorado.

Reservations can be made with John Albanese through the Wyoming Geological Association, P. O. Box 545, Casper, Wyo.

GRANT
Since 1927

GRANT
LINER PULLER



DESIGNED for all pumps with removable liners.

ENGINEERED to pull the most stubborn liner without damaging liner bore.

BUILT with a minimum of parts, husky enough for long, trouble-free wear.

AVAILABLE in just two sizes to cover the range from 3½ to 9" liners inclusive.

WRITE —for Bulletin 14, *today!*

GRANT OIL TOOL COMPANY
Main Office & Plant
2042 E. Vernon Ave., Los Angeles 58, California
California
Ventura — Phone Miller 3-6767 • Avenal — Phone 228
Bakersfield — Phone 50507 • Compton — Newmark 5-8041
Texas
Odessa — Phone 64892

Tames the Toughest Outlaw Wells

...Ideal for any well

the New Pacific TYPE "M" PLUNGER PUMP

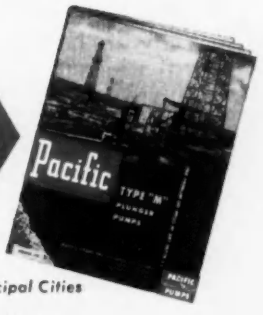
with Patented Top Lock and Valveless Plunger*

- Holds the plunger in a rigid stationary position
- Creates a fluid seal above the plunger
- Fully protects plunger from abrasives and pressures
- Makes abrasive pumping practical at any depth

* Patent Number 2509223

PACIFIC *Precision Built* **PUMPS**

Send for New Bulletin 120...



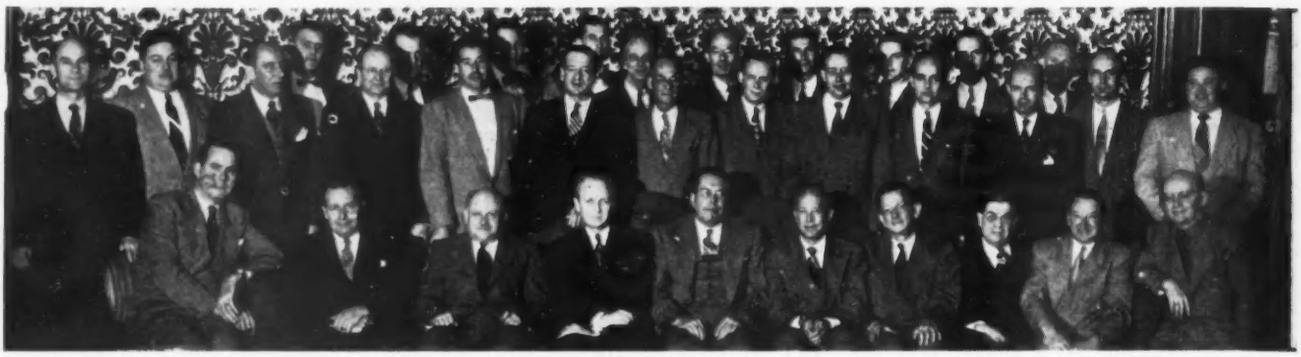
Pacific Pumps inc.

ONE OF THE DRESSER INDUSTRIES

HUNTINGTON PARK, CALIFORNIA
Export Office: Chanin Bldg., 122 E. 42nd St., New York—*Offices in all Pricipal Cities*
MID-CONTINENT DIVISION: 1221 E. 1st St., Tulsa, Oklahoma
DISTRIBUTED IN CANADA BY: Lucey Export (Canada) Ltd., 1215 9th Ave., Calgary

DW-8

News of Service and Suppliers



Enterprise Diesel Sales Holds Annual Meeting

Enterprise Engine & Machinery Company held its recent annual diesel engine sales meeting at Diablo Country Club near San Francisco. Members of the national sales organization joined home office personnel for a three-day session. Those participating included: (seated left to right) J. L. Adams, G. C. Rasey, J. H. Sheusner, P. I. Birchard, W. E. Butts, J. Wendell Coombs, W. E. Clayton, Jr., G. B. Wright, R. E. Kroeck, and G. J. Brusher. (Second row) M. T. Prendergast, Wren Malone, P. K. Wabnig, H. L. Hansen, J. C. Roberts, J. Neil Brophy, T. S. Pennebaker, W. E. Bishop, H. T. Anderson, Paul Sullivan, William F. Haddon, Bruce Robbins and Dale Blanton. (Back row) J. E. Barthmaier, Ken Cramer, H. D. Bahr, R. L. Rahn, W. H. M. Porter, T. S. White, J. F. Yeldell, C. R. Carmichael, George Cashman and H. R. Hogaboom.

Continental Motors Opens Sales Office in Tulsa

Continental Motors Corp., Muskegon, Mich., manufacturer of specialized internal combustion power since 1902, has opened a sales office in Tulsa. Howard T. Conrey, manager of the new office, has been with the Sales department of Continental Motors for many years.

New Engineering Firm Formed in Amarillo

Abrasion & Corrosion Engineering Company, a new firm devoted exclusively to manufacturing, research and testing in the field of abrasion and corrosion control, has been established at Amarillo, Texas.

The firm's three partners, B. W. Moore, E. R. McCamy and A. G. Remke, have more than 30 years experience in the rubber lining field. The firm plans to use many kinds of rubber and plastic compounds in conjunction with steel plate and other structural metals to reduce corrosion and abrasion, thereby extending the useful life of equipment.

Research is to be one of the main services of the company in order to find the desired application to meet all abrasion, corrosion and impact problems.

Bilderback Joins Staff Of Cable Engineering

E. G. Bilderback has joined the staff of Cable Engineering, petroleum engineering firm of Wichita Falls, Texas. Bilderback formerly was with Magnolia Petroleum Company for three years, recently associated with Magnolia's water-flooding project in the Kermit field as a mud engineer and equipment specialist.

Charles T. White, Jr., Named Goodyear District Manager

Charles T. White, Jr., formerly belting sales engineer, has been appointed Pittsburgh district manager, Industrial Products Division, Goodyear Tire & Rubber Co.

White joined Goodyear in 1947 as factory office trainee, and later entered the Industrial Products Division of the company as a clerk at Charlotte, N. C., in 1948. White was promoted to industrial products field representative at Greensboro, N. C., and later made a senior staffman in industrial products sales at Akron.

Baash-Ross Announces Executive Advancements

L. F. Baash, president of Baash-Ross Tool Company since the founding of the company in 1920, was recently named chairman of the board of directors and Frank L. Tooley was elected president. Tooley formerly was executive vice president.

G. D. Johnson, formerly vice president —research and development, was named executive vice president and T. A. Boyd, formerly secretary-treasurer, was named vice president, secretary and treasurer.

Seismograph Service Promotes Leedy, Finn and Pohly

At the recent meeting of the board of directors of Seismograph Service Corporation, Tulsa, three advancements of personnel were made.

F. B. Leedy, formerly assistant treasurer, was promoted to treasurer and a director. R. S. Finn, formerly manager of instrument research, was named vice president of Lorac Service Corporation and manager of Lorac Maritime Corporation, subsidiary companies of Seismograph Service. Richard A. Pohly, presently serving as manager of the company's Gravity Division, was named vice president.

M. J. Crose Manufacturing Names John W. Brand Sales Engineer

M. J. Crose Manufacturing of Tulsa has announced the appointment of John W. Brand as sales engineer. Brand will handle sales and service for the pipe line equipment manufacturing company.

A graduate of Oklahoma University, Brand entered the pipe line construction field with Williams Brothers from 1940 until 1949. Before joining Crose, he was with Midwestern Engine and Equipment Company.

John W. Brand

Bethlehem Supply Opens Sales Office in Denver

Bethlehem Supply Company has opened a new sales office in Denver, Colo. The office is located in Suite 203, Patterson Building. R. R. Estes, formerly at Casper, Wyo., is sales representative in charge of the office and will work under E. S. Lewis, Rocky Mountain District manager. The office was opened to provide better sales coverage to increasing number of oil companies locating in Denver, Bethlehem officials said.

Dowell Incorporated Transfers Alfred Gionta to Wyoming

Alfred Gionta has been transferred to Casper, Wyo., where he will be area engineer for Dowell Incorporated. Gionta will coordinate the engineering and sales work at various Dowell offices in the Rocky Mountain area and provide additional service for operators in the territory.

Gionta joined Dowell at Lafayette, La., in 1946. After serving in Lafayette and Houma, La., Gionta went to Maracaibo, Venezuela, where he was Western Venezuela manager for United Oilwell Service, a Dowell associate company.

Warren and Adams Promoted By Gooydear Rubber Company

R. B. Warren has been named manager of Industrial Products departments of Goodyear Tire and Rubber Company at Akron, Ohio, and L. W. Adams has been promoted to Warren's former post as southern sales manager of the Industrial Products division.

Warren joined Goodyear in 1927 after being graduated from Ohio Wesleyan University. In 1933 he became an industrial products field representative in Atlanta, Ga., transferring to New York in 1938. Warren was assistant head of the Navy rubber director's office during 1942-1945 and became industrial products district manager at Pittsburgh in 1947. He received the southern sales manager job in 1949.

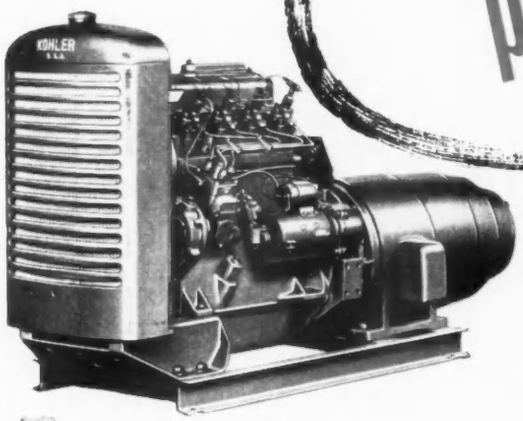
Adams, a Pittsburgh district manager for the Industrial Products division since 1949, joined Goodyear in 1943 and later was assigned to the Boston district as a field representative.

OUR ADDITION OF

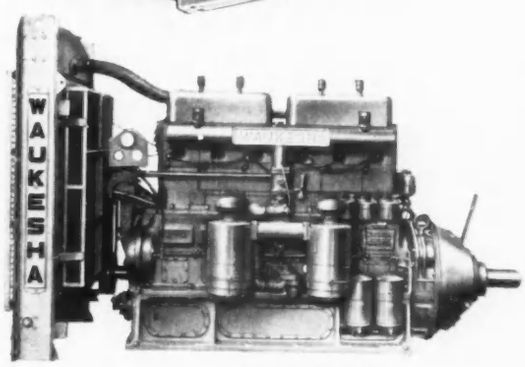
KOHLER ELECTRICAL PLANTS AND ENGINES

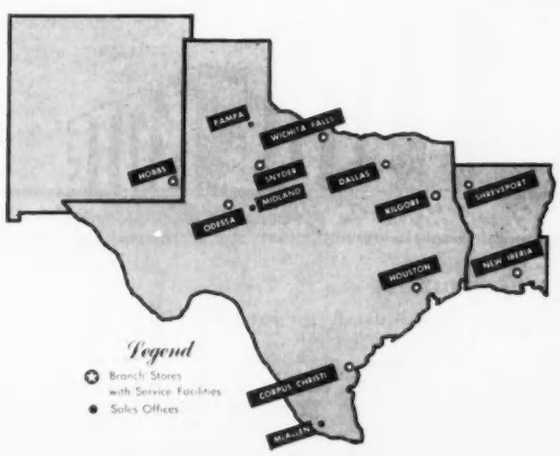
SUMS UP T . . .

complete power service



Now, your nearby Waukesha Sales and Service, Inc., Branch is equipped to give even more thorough service to your power problems. In addition to a complete line of Waukesha Engines and parts, famous Kohler Electrical Plants and Air Cooled Engines are now available at the Waukesha Sales and Service, Inc., Branch in your area. These dependable Kohler plants provide an independent source of electricity capable of performing hundreds of routine needs as well as a stand-by protection against power failure. Models range in size from 500 watts to 30 KW and are powered by 4-cycle gas, gasoline or diesel engines. The low cost of these compact units is often offset by losses prevented during a single power failure. And don't forget service! Our modern shops at locations shown below are staffed with experienced mechanics who uphold the Waukesha Sales and Service, Inc., reputation of unsurpassed 'round the clock service. Call or write today for further information on any Waukesha or Kohler products.





Waukesha

SALES & SERVICE, INC.

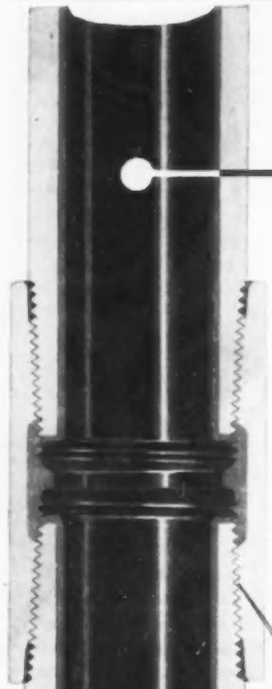
1422 MAURY ST. • HOUSTON, TEXAS

Homco Announces Personnel Changes and Promotions

Houston Oil Field Material Company, Inc. has announced the following personnel changes and transfers: Ralph E. Brumley, New Iberia, La., from directional drilling engineer to assistant district superintendent of directional drilling, New Iberia; W. T. Carroll, from sales and service representative, Odessa, Texas, to district superintendent, Farmington, N. M.; Burley Q. McAdams, from string shooting service in Houston, to string shooting service, Farmington, N. M.; L. C. Schneider, string shooting service, New Iberia, to string shooting service, Houma, La.; H. E. White, from Houston to Victoria, Texas, as fishing tool supervisor; and J. K. Young, fishing tool supervisor, from Victoria to Houston.

Other changes involve Walter Harrison, transferred from Houston to Corpus Christi, Texas, as division manager over Corpus Christi, Alice and Edinburg, Texas, branches; Rodney N. Baker, general field salesman of the southwest Texas area; H. H. (Jelly) Hughes, from New Orleans to Houston as assistant general superintendent over the service division; C. J. Erwin from Houma to New Orleans as assistant division manager over the Louisiana and Mississippi Division; and R. H. McClendon, appointed district superintendent over the Houma, La., area.

Employes joining Homco are Albert F. Coleman, fishing tool supervisor at Houston; Frank F. Ellis, fishing tool supervisor at Casper, Wyo.; and Curtis L. Johnson, directional drilling engineer, Houston.



Using TK-43 Anti-Corrosion Lining

is like getting twice the pipe for your money!

This extra-thick, rubber-like tough plastic lining defeats **both** corrosion and abrasion — makes pipe last longer. Applied by Tube-Kote experts to your new or used pipe, TK-43 gives you the protection of plastic combined with the strength of steel. TK-43 is a polyvinyl chloride plastic, centrifugally cast in one flawless operation.

Now! Your pipe joint corrosion problem is whipped: this cross-section photo shows how a joint or coupling can be machined, coated with TK-43, and threaded for a fully-protected perfect seal of all surfaces, even the ends! You get top to bottom protection in disposal wells, your flow lines last longer, and your production tubing needs less attention when coated with tough TK-43. Mail the coupon below for full details today.

TUBE-KOTE

First Name In Corrosion Resistance

TUBE-KOTE T.M. Reg.

Tube-Kote, Inc.
P. O. Box 20037, Houston 25, Texas.

Please send me full details on your TK-43.

Name_____

Firm_____

Street_____

City_____ State_____

SEND THIS COUPON TODAY FOR FULL ENGINEERING DATA ON TK-43

William F. Dressen

E. A. Kelley

D. S. Simon

Bob L. Crain

Otis Pressure Control Names Four New Division Managers

Otis Pressure Control, Inc., has announced the promotion of four division managers. E. A. Kelley, division manager in Odessa, has been placed in charge of the Corpus Christi division where he will direct all wire line operations, tubing under pressure, and running and pulling Otis subsurface controls. William F. Dressen has been transferred from Corpus Christi to Odessa to become division manager in charge of service operations for West Texas and New Mexico. Dressen replaces Kelley.

The company's new East Texas-North Louisiana division manager is D. S. Simon, who will work out of the Longview office supervising wire line and other service operations. Bob L. Crain has been assigned to manage the northern division office in Oklahoma City. Crain formerly was district manager in Longview.

Otis also announced the opening of an office at Pauls Valley, Okla., with Nat Green as operator-in-charge.

Andrew F. Kritscher Receives U. S. Steel Corporation Promotion

Andrew F. Kritscher has been appointed assistant chief engineer of process development of National Tube Division, U. S. Steel Corporation. A native of Philadelphia, Kritscher was graduated from Carnegie Institute of Technology in 1937 and joined U. S. Steel that year as a student engineer at the Ellwood City Works of National Tube. In 1945 he was transferred to the division's Pittsburgh office as staff engineer and was made development engineer in 1951. Kritscher, a holder of numerous patents, is chairman of the combustion section of the Association of Iron and Steel Engineers.

Williams Represents Firms On South American Trip

E. E. (Bill) Williams, export representative of Technical Oil Tool Corporation, is representing Totco and the Lucey Export Corporation on a trip to Colombia, Venezuela and Mexico. Williams will return for the International Petroleum Exposition this month in Tulsa.

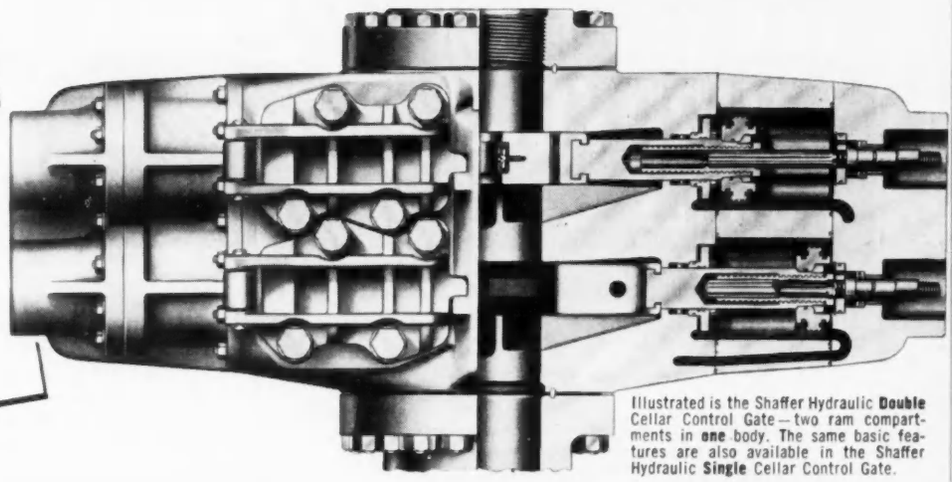
Before you buy any cellar control gates . . .

Compare

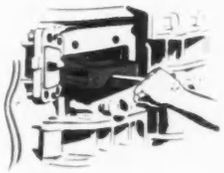
ALL OTHERS AGAINST THE MULTIPLE ADVANTAGES OF

SHAFFER HYDRAULIC GATES!

Before you invest in cellar control gates, make a feature-by-feature comparison of Shaffer Hydraulic Cellar Control Gates with any other similar equipment on the market . . .



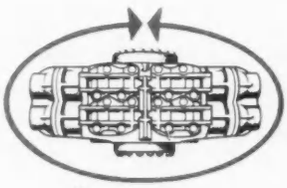
Illustrated is the Shaffer Hydraulic **Double** Cellar Control Gate—two ram compartments in **one** body. The same basic features are also available in the Shaffer Hydraulic **Single** Cellar Control Gate.



Compare

RAM CHANGES!

Changing rams in a Shaffer Hydraulic Gate is far simpler and quicker. Simply unbolt and open two doors, slide out the old rams, slide in the new—then close and bolt the doors. There's nothing to disconnect—and closing the doors automatically aligns rams for proper operation. Best of all, **complete ram changes can be made whether pipe is in or out of the hole!**



Compare

SEALED DESIGN!

In Shaffer Hydraulic Gates all moving parts—including piston rod ram shafts—are completely enclosed within the Gate body. There are no exposed moving parts to become wedged or damaged by objects falling into the cellar—nothing to become corroded by chemical or salt drippings. Even the locking shaft is non-rising—fully protected!

Compare

COMPACTNESS!

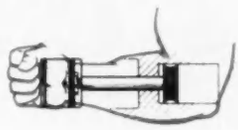
The Shaffer Hydraulic Double Cellar Control Gate contains **two** ram compartments unitized into **one** body . . . and even in sizes as large as 13⅜" (12" series 900) **requires only 30" total height.** Smaller sizes even less!

Compare these cellar-saving, space-cutting measurements against comparable equipment.

Compare

INTERNAL SAFETY!

With Shaffer Gates you don't have to worry about mud or sand interfering with free ram travel. The rams travel on high narrow guide ribs above the steeply-sloped ram compartment bottoms. Mud and sand quickly drain back into the well—with no detrimental accumulations to interfere with ram operation!



Compare

OPERATING SIMPLICITY!

Simple design means simpler maintenance, more trouble-free operation. Note how the operating cylinders in Shaffer Hydraulic Gates are **directly behind** the rams and operate through a rugged **one-piece** connection. No complicated multiple-element connections to wear or jam!

By making such a comparison you will readily see why these and still other important advantages engineered into Shaffer Hydraulic Cellar Control Gates make them, by far, the outstanding choice for protection against pressure emergencies. In fact, on every point essential to modern cellar control gate protection, this unit is unsurpassed.

See your nearest Shaffer representative for complete details—or write direct!

Write for a free copy of the 1952-53 Shaffer Catalog!

See the Shaffer section—pages 4609-4688 of your 1952-53 Composite Catalog!

30 years OF OIL TOOL LEADERSHIP

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

SHAFFER TOOL WORKS, Brea, California • California Service Shops; Santa Fe Springs and Taft
HOUSTON, TEXAS, 6006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Street
OKLAHOMA CITY, OKLAHOMA, Acme Oil Tool Company, 1001 S. E. 29th STREET
FARMINGTON, NEW MEXICO, Shaffer Tool Works, Post Office Box 546
CASPER, WYOMING, Shaffer Tool Works, Post Office Box 1788
EXPORT SALES OFFICE: Shaffer Tool Works, 500 Fifth Avenue, New York, N. Y., U.S.A.

J. M. Taylor

W. R. Wheeler, Jr.

American Iron & Machine Works Announces Sales Promotions

W. R. Wheeler, Jr., special sales representative in Tulsa, has been promoted to the newly-created position of assistant sales manager of American Iron and Machine Works Company of Oklahoma City. Wheeler joined the company in 1935.

Replacing Wheeler in Tulsa will be J. M. Taylor, former export manager for American Iron and Machine Works in New York since 1949. Taylor served in various capacities in the American Iron Sales department since 1936.

Brewster Company Promotes Johnson to Assistant Manager

J. D. Johnson has been promoted to assistant manager of sales for The Brewster Company, Shreveport, La. Johnson has been with Brewster during the past 11 years and, until his recent promotion, was sales representative in the Ohio area.

YOU GET THEM *ALL* WITH STURDYBILT *Prefabricated* HOUSES . . .

MOVABILITY

DURABILITY

ECONOMY

STYLE

STURDYBILT Prefabricated Buildings are especially designed for oil field camps. That's why they were made to be moved when necessary. Their unusual durability is necessary so they will stay in good repair in any kind of climate. Their reasonable cost suits oil company management and their comfort and style pleases families who live near the company's operation.

Why take less? Specify STURDYBILT Prefabricated buildings for every oil field housing need.

Manufacturers of Special Millwork

Distributors of Johns-Manville Building Materials

Curtis Woodwork

STURDYBILT PREFABRICATED, DEMOUNTABLE HOUSES

SOUTHERN MILL & MANUFACTURING CO. • TULSA, OKLAHOMA

STURDYBILT HOUSES COMPLY WITH COMMERCIAL STANDARD CS125 OF THE NATIONAL BUREAU OF STANDARDS FOR PREFABRICATED HOMES

The Western Company Announces Appointment of Engineers

Cyrus V. Helm has been appointed to head a newly created Field Engineering department of The Western Company. Helm will direct operations of the department in providing geological and chemical engineering services in conjunction with Western Technical oil well services.

Cyrus V. Helm

A graduate of Dartmouth College, Helm joined Western Company in 1948 and has served in many engineering and supervisory capacities. Helm's headquarters will be Midland, Texas.

Another company promotion announced is that of Morris W. Frack to consulting mechanical engineer and B. J. Terrell, former experimental and development engineer, to chief mechanical engineer to succeed Terrell. Both will have offices at Midland.

Rockwell Manufacturing Company Opens New Office in Georgia

Rockwell Manufacturing Company has opened a new office, warehouse and service building in Atlanta, Ga. Complete stocks of standard Rockwell gas, water and oil meters, gas regulators and Nordstrom valves and repair parts will be carried. A maintenance department has been established to provide immediate repair work on Rockwell products to save customers freight charges to and from the factory.

J. W. Northcutt, southern regional sales manager, and R. A. Johnson, newly appointed district sales manager, will have headquarters at the new location from where they will direct the sales activities for the southeastern district.

United States Steel Announces Plans for Research Center

A new research center for developing new and better steels will be constructed by United States Steel Corporation in a rural area of Allegheny County near Pittsburgh, Penn. The center will be devoted to applied research and better coordination of research projects already under way.

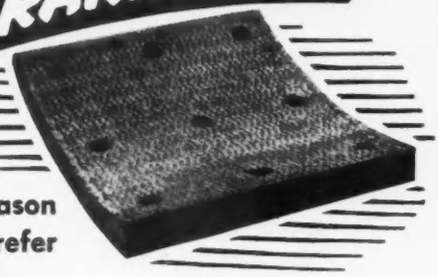
The physical plant will consist of three buildings with a combined floor area of 132,000 square feet. These buildings are to include a main laboratory, an experimental engineering shop and an industrial process development building.

Youngstown Sheet and Tube Announces Personnel Changes

H. R. Ryan, superintendent of the Bessemer and Open Hearth department at The Youngstown Sheet and Tube Company's Campbell plant has been transferred to Indiana Harbor Works, East Chicago, Ind., as superintendent of the company's new Open Hearth department.

Robert Frushour, formerly with the Edgar Thomson works of United States Steel Company, has joined Youngstown succeeding Ryan as superintendent of the Bessemer and Open Hearth department at Campbell.

SMOOTHNESS OF BRAKING...



. . . another reason why drillers prefer

Standco NO-SMOKE BRAKE LINING

There's no grabbing when Standco Lining is used. It has a nice feed-off and slight lever pressure controls the heaviest strings of pipe.

More deep wells have been drilled with Standco than with all other blocks combined.

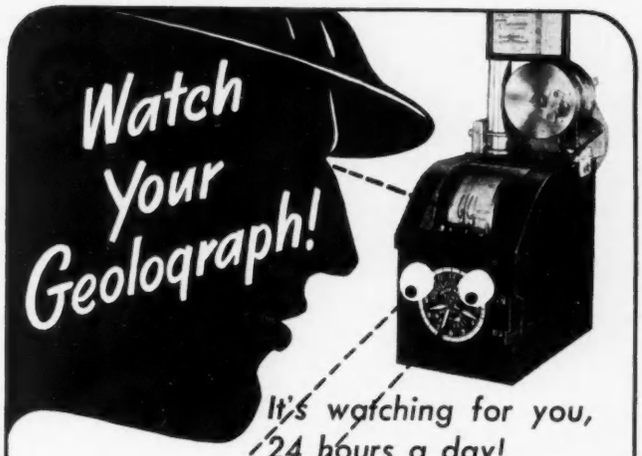
Be sure Standco No-Smoke Brake Lining is on all your rigs.

STANDCO BRAKE LINING COMPANY

Factory and General Offices

2701-2801 Clinton Drive — Houston, Texas

Watch Your Geolograph!



It's watching for you, 24 hours a day!

- Minutes Per Foot
- D.S.T. Packer Points
- Round Trip Time
- Net Pay Thickness
- Formation "Breaks"
- Connections
- Accurate Coring Points
- Correlation "Tops"
- Feet Per Hour
- Guide For Bit Change
- Depth At All Times
- Down Time

GEOLOGRAPH
MECHANICAL WELL LOGGING SERVICE
P.O. Box 1291 • Oklahoma City 1, Okla.

Farmington, New Mex.—Liberal, Kan.—Oklahoma City, Oklahoma
Abilene, Houston, Odessa, Lubbock and Wichita Falls, Texas
Bakersfield, Cal.—Shreveport and Baton Rouge, La.
Casper, Wyo.—Glendive, Mont.—Sterling, Colo.
Calgary and Edmonton, Alberta, Canada
Regina, Saskatchewan, Canada

Now your EARS can "SEE" those hidden troubles

NEW MARSH

Serviceman Soundscope

. . . cuts servicing and maintenance costs

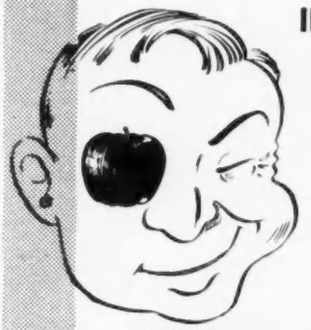
Most effective instrument ever developed for pin-pointing and identifying mechanical defects. Saves time and dollars tracking down troubles in bearings, gears, mechanisms . . . detects leaks, knocks, piston slaps—any defects that make a sound. A precision instrument of Marsh quality, sensitive to faintest sounds . . . with handy probe and headband as illustrated. A remarkable tool, moderately priced.

Ask for Circular

MARSH INSTRUMENT CO.

Sales affiliate of Jas. P. Marsh Corporation

Dept. K, Skokie, Illinois



IF *SHIPPING WORRIES* MAKE YOU SIGH?

WE'LL BE THE APPLE OF YOUR EYE!

We'll keep every complicated detail of shipping in apple pie order for you! Call The Tulsa Crating Company for these services:

PACKAGING for export or domestic shipment.
SCIENTIFIC PROCESSING against corrosion, moisture, air dust, all climatic conditions.
DOCUMENTATION: Preparing and forwarding documents needed for export shipping.
AIR SHIPPING: As agent for International Air Transport Association we arrange all details of shipment by air.
COUNSELING on details of export shipping.

TULSA CRATING CO.
519 SO. ROCKFORD • TULSA 10, U.S.A.
PHONES 3-6482, 3-3492

National Supply to Expand Facilities in Wyoming

Expansion of facilities to provide a concentration point for a wide range of oil field machinery and equipment is planned by the National Supply Company at Casper, Wyo. The expansion is intended to provide better service to the company's eight other stores in the Northwest Division.

Administrative changes include the moving of the Northwest Division headquarters from Casper to Denver involving the transfer of J. W. Gillespie, division manager; Robert D. Stottlemyer, assistant division manager; A. A. Anderson, division sales manager, and R. K. Ford, division merchandising supervisor.

Raybestos-Manhattan Plant Is Opened in Wisconsin

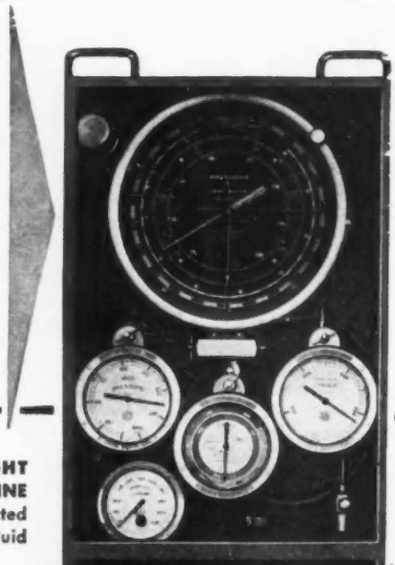
Opening of a new rubber roll covering plant for its subsidiary, The Manhattan Rubber Manufacturing Company at Neenah, Wis., has been announced by Raybestos-Manhattan, Inc., Passaic, N. J. The new plant expands existing facilities for rubber covering rolls for the paper and other industries in the Midwest.

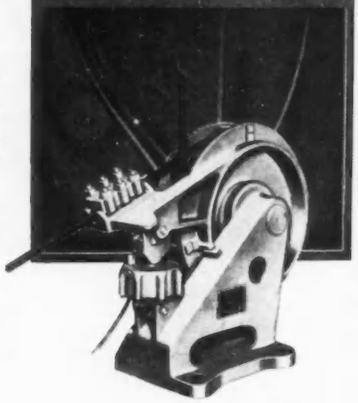
The Manhattan Rubber Manufacturing Company has been located in Neenah for 20 years. It was established as an auxiliary plant of the Manhattan Rubber Division of Raybestos-Manhattan, Inc., Passaic, N. J., where paper mill and other rolls have been rubber covered for 60 years. A third roll covering plant is operated at North Charleston, S. C.

Accurate

under all conditions

HYDRAULICALLY OPERATED





THE MARTIN DECKER TYPE "D" WEIGHT INDICATOR AND IDEAL TYPE "D" WIRE LINE ANCHOR COMBINATION is positively unaffected by temperature changes, leaks, or variations in fluid volume.

More Sensitive—More Convenient

A CONVENIENT WEIGHT INDICATOR which shows accurately the weight of the drill string directly in thousands of pounds—the pull on stuck pipe—shows tight hole when making trips and the total load on the derrick.

A BIT WEIGHT INDICATOR shows the driller directly and accurately in thousands of pounds on a 4 to 1 magnified scale the Net Weight on the bit.

A VERNIER WEIGHT INDICATOR graduated in 1000-lb. increments is extremely sensitive for fishing, milling, cutting, etc.—showing variations of as little as 25 lbs. in 50,000.

A SIMILAR RECORDER gives the engineer a permanent record of each 24 hours operation.

AN ADAPTABLE WEIGHT INDICATOR which can be mounted at the driller's position or at the most convenient location where the slightest change in hook load can be interpreted.

Write for Descriptive Literature!

"D", "E" and "F" Combinations

are in use all over the world.

There are three combinations:
THE TYPE "D"—
for a dead line load of 60,000 lbs.
THE TYPE "E"—
for a dead line load of 90,000 lbs.
THE TYPE "F"—
for a dead line load of 40,000 lbs.

HOME OF THE WEIGHT INDICATOR

MARTIN DECKER CORP.

LONG BEACH, CALIFORNIA

SAN JOAQUIN VALLEY: T. I. CULLEN, BAKERSFIELD, CALIFORNIA
MID CONTINENT DISTRIBUTOR: REED ROLLER BIT COMPANY, HOUSTON, TEXAS
CANADIAN DISTRIBUTOR: REED ROLLER BIT COMPANY OF CANADA, CALGARY & EDMONTON, ALBERTA

MARTIN DECKER WEIGHT INDICATORS AND IDEAL WIRE LINE ANCHORS ARE ALSO SOLD THROUGH THE NATIONAL SUPPLY EXPORT CORP., THE NATIONAL SUPPLY CO. AND OTHER RECOGNIZED SUPPLY HOUSES.

J. B. Wood H. H. Peters

Technical Oil Tool Corporation Announces Election of Officers

The Board of Directors of Technical Oil Tool Corporation has announced the election of J. B. Wood, former president of the corporation, to the newly created position of chairman of the board. H. H. (Pete) Peters, former vice president, has been named to fill the presidency. E. G. McConnell, Mid-Continent manager, was named vice president—Mid-Continent.

E. G. McConnell

Wood organized TOTCO in 1930 and has headed the company since that time. Peters began with the firm in 1936 and was elected to the vice presidency in 1946. Mid-Continent manager since 1938, McConnell joined the company in 1935.

Harrisburg Steel Stockholders Approve Acquisition of Heckett

Stockholders of Harrisburg Steel Corporation approved acquisition of Heckett Engineering, Inc., Butler, Penn., and its wholly owned subsidiary, Heckett International, Inc., confirming recommendations made at a board of directors meeting of Harrisburg Steel in December, 1952.

To the present list of Harrisburg Steel products, which include high pressure seamless steel cylinders, seamless pipe couplings, drop-forged flanges, commercial drop forgings, liquefied petroleum gas cylinders, and small steel bars, is added Heckett Engineering's operations in the handling and utilization of steel works slag and reclamation of the metal contained therein. Heckett Engineering now operates slag reclamation facilities in 11 major steel plants of the United States and Canada.

E. H. Heckett, president of Heckett Engineering, was elected director and chairman of the board of Harrisburg Steel Corporation. W. K. Jones, vice president of Heckett, and Mark W. Koch, treasurer of Leonard J. Buck, Inc., Jersey City, N. J., were elected directors, expanding to ten the former seven-man board of Harrisburg Steel Corporation which includes Richard J. Buck and Charles Garside, New York; D. M. Horner, C. L. Keister, H. M. Reeser, J. T. Simpson, and Edgar Z. Wallower, Harrisburg, Pa.

Officers of Harrisburg Steel Corporation are E. H. Heckett, chairman of the board; J. T. Simpson, president; H. M. Reeder and D. M. Horner, vice presidents; E. L. Martin, treasurer; Lester J. Sutton, assistant treasurer, and Clair R. March, secretary.

OUR POLICY:

Serving One Area Well

with known dependable products!

DISTRIBUTING THE PRODUCTS OF THESE LEADING MANUFACTURERS:

Baash-Ross Tool Co.
National Tube Co.
Republic Steel Corp.
Hughes Tool Co.
Reed Roller Bit Co.
Cameron Iron Works
Wickwire Spencer Steel Co.
Whitlock Cordage Co.
The Lunkenheimer Co.
Edward Valve & Mfg. Co.
Hewitt Rubber Corp.
Mission Mfg. Co.
Stockham Valves & Fittings, Inc.
Web Wilson Oil Tools
Link-Belt Co.
Nordstrom Valve Co.
National Transit Pump & Machine Co.
Taylor Forge & Pipe Works
Phelan Faust Paint Co.
Rust-Oleum Corp.
Hancock Valves
Ashcroft Gauges
Gates Rubber Co.
Worthington Corporation
and others

We at Standard believe that serving one area efficiently is mighty important. That's why our NINE STORES are located ideally for reaching every active field and the off-shore drilling right along the Gulf Coast. That's why, too, you find the manufacturers of the tools we furnish are the KNOWN DEPENDABLE makers throughout the industry. Add to that the careful and experienced service at Standard and it adds up to *serving one area well* . . . that's our main job!

With the continued demands of increased drilling activity based on our changing economy, operators rely on the service and the nationally recognized equipment available to them at their nearest Standard Supply branch. They know they save time, money and labor by relying on men who know Oil Field requirements.

You will find complete stocks of drilling and production tools as well as friendly cooperation and understanding of your problems at every Standard Supply Store.

We invite you to standardize on STANDARD.

Standard

SUPPLY AND HARDWARE COMPANY

NEW ORLEANS, LOUISIANA

Branches — Lake Charles, New Iberia, Leeville, Houma, Harvey and Baton Rouge, La.; Natchez, Miss.; Houston, Texas.

Sales Office — 609 Praetorian Bldg., Dallas, Texas.

NEW!
KENNAMETAL
Light-Weight Ball
⅓ lighter than Steel
Lasts 20 times longer

Kennametal Light-Weight Titanium-Carbide* Balls minimize down-the-hole check valve troubles caused by ball flutter, cage wear, and fluid pounding. Their shock- and wear-resistance is almost equal to that of regular Kennametal, assuring long service in pumping fluids with sand, water, sour crudes, hydrogen sulphide gases. Costly string pulling is less frequent—and production is increased.

Kennametal API Titanium-Carbide Balls are stocked and sold by your regular supplier. Kennametal Inc., Latrobe, Pa.

Called Kentanium

KENNAMETAL Balls and Seats

Shock- and wear-resistant Kennametal Balls and Seats are furnished in matched sets. Balls available in either light-weight Titanium-Carbide or regular Kennametal Tungsten Carbide. Seats are Tungsten Carbide.

KENNAMETAL®
PUTS AN END TO DOWN-THE-HOLE CHECK VALVE TROUBLE

C. Paul Clark — John N. MacKendrick

George W. Probst — F. W. Laverty

Clark Bros. Announces Personnel Changes

The board of directors of Clark Bros. Co., Olean, N. Y., has announced several changes in the membership of the board and corporate officers as a result of the relinquishing of vice presidential responsibilities by several of the senior officers and retirement policies of the company.

C. Paul Clark, former president, has been named chairman of the board. Clark has been associated with the organization, which was founded by his father, for 35 years. Clark was appointed president in 1936 and is vice president and director of Dresser Industries, Inc.

John N. MacKendrick has been named president of Clark Bros. Co. succeeding Clark. MacKendrick joined the company in 1928 as a design engineer, later becoming chief engineer and vice president-engineering. F. W. Laverty, a Clark Bros. employe for 27 years, has been appointed executive vice president.

George W. Probst, formerly western regional sales manager, becomes vice president-sales, filling the position vacated by David H. Hutchcraft. Probst will have headquarters at the home office and factory in Olean, directing sales activities of all Clark offices.

Hutchcraft and Frederic H. Light, former vice president, secretary and treasurer, have relinquished their vice presidential responsibilities in line with the company's retirement policy but will remain with Clark in a consulting and advisory capacity.

Engine Manufacturers Announce Officers

R. C. Wietersen, director of purchases of the Buda Company of Harvey, Ill., has been elected president of the Internal Combustion Engine Institute, whose membership includes the major manufacturers of high-speed gasoline and diesel engines.

Other officers elected at the annual meeting were J. E. Heuser, Engine Division, Le Roi Company of Milwaukee, vice president; R. H. Kerr, Climax Engine and Pump Manufacturing Company of Clinton, Iowa, secretary; and J. D. Cook, Hercules Motor Corporation of Canton, Ohio, treasurer.

William O. Wilson Retires From Worthington Corporation

William O. Wilson, commercial vice president of Worthington Corporation, has retired after 53 years service with Worthington and its predecessor companies.

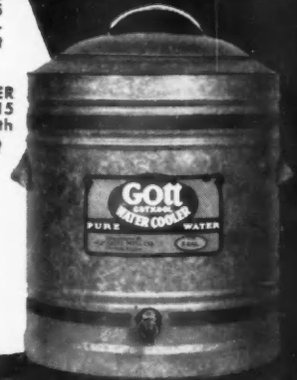
Since 1944 Wilson has been responsible for general supervision and direction of all of the corporation's commercial activities in the Chicago, St. Louis, Kansas City and St. Paul district office territories. Wilson began his service in 1898 when he joined the Jeanesville Iron Works Company as a machinist.

Gotkool
water cans and coolers

GOTKOOL WATER CAN
Made in 1½, 2, 3, 5, 10, 15 and 20 gallon sizes. Push-Button Faucet at slight additional cost.

KEEP PURE DRINKING WATER ALWAYS HANDY

GOTKOOL WATER COOLER
Made in 2, 3, 5, 8, 10, 15 and 20 gallon sizes with Push-Button Faucet.



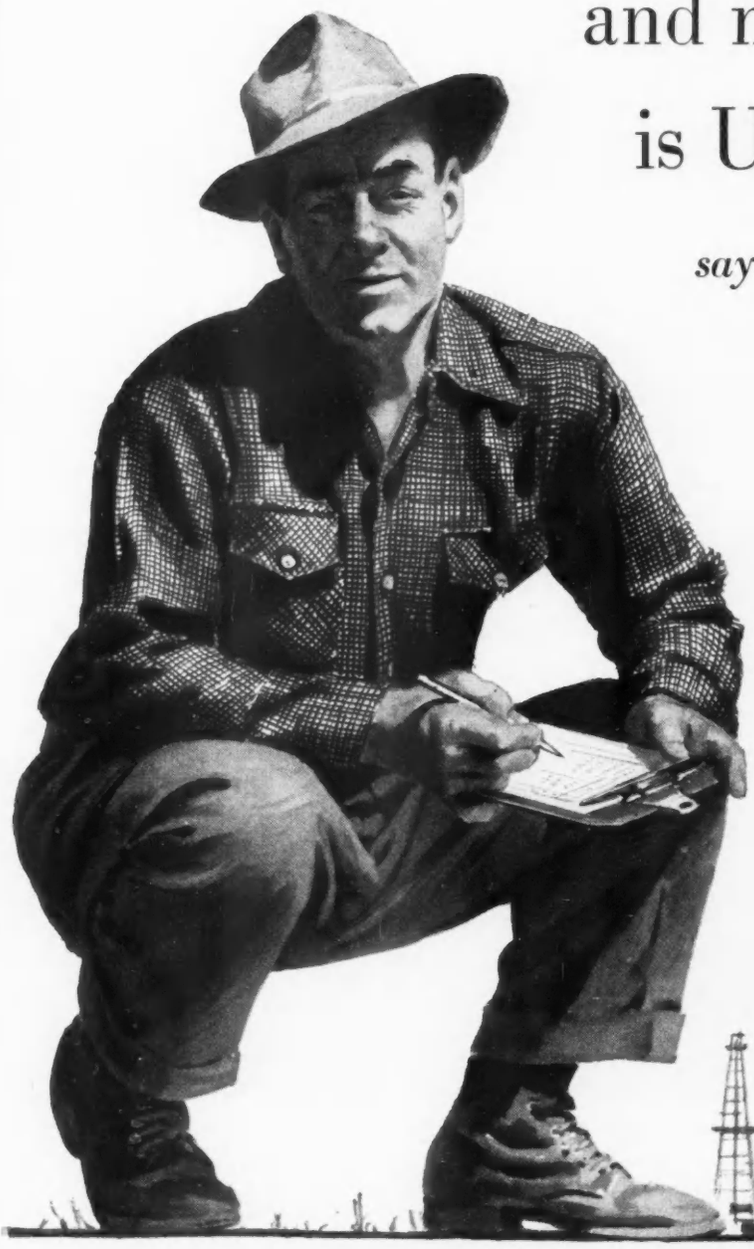
GOTT Water Coolers are the convenient way to keep drinking water handy to the worker, protect it from impurities. Their exclusive construction keeps water cool for long periods. Snug-fitting, large, removable top, handy non-leaking push-button faucet. GOTT Water Cans for handy field use. Your supply store has them, get one today!

STANDARD OF THE OIL FIELDS
Insist on the Genuine

H. P. GOTT MFG. CO.
WINFIELD, KANSAS

"I'm always fighting down-time..... and my best weapon is U.S. Royal 4,"

says "Red" Royal



"I've got better use for my boss' dough," says Red, "than tying it up in extra equipment and standby hose. I'm fed up with switching, lubrication and down-time because of hose. For me, I'll take U.S. Royal 4 Rotary Hose – it can take drilling pressure of today's pumps and *handle every job all the way from spud to pay.*"

"Red" is right on the button. Another reason why he likes Royal 4 is because it comes shipped in a special crate – a mighty convenient container when you're moving from rig to rig.

Developed by Science—
Proved by Drillers

Available in all FIELDS at SUPPLY STORES

PRODUCT OF U.S. RUBBER — SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

PERFORATE TUBING IN THE WELL

KINLEY TUBING PERFORATOR

M. M. Kinley Company Licensees

BEAUMONT
Associated Engineers, Inc. 5-7046, ZF 8-2023
CASPER
Wire Line Service 3-5264
CORPUS CHRISTI
Tubokut Wire Line Service 5-1811
Tuboscope 3-3512, 4-3137
HOBBS
Cecil Horne 3-5396
HOUSTON
Tuboscope JU-0577, MO-4279
KILGORE
Tuboscope 5198, 5218
MIDLAND
Luccous 4-8471, 4-4320
NEW IBERIA
Tuboscope 2-3831, 4-1327
NEW ORLEANS
Associated Engineers, Inc. AU-7696
OKLAHOMA CITY
Rainbo Service Co. . . . ME 4-2131, ME 2-2024
SHREVEPORT
Tuboscope 2-5663

V. P. Rumely L. N. Blugerman

Rumely and Blugerman Named Vice Presidents of Crane Co.

Crane Company has announced the election of V. P. Rumely as senior vice president—manufacturing and L. N. Blugerman as vice president. Blugerman will have charge of production in the company's plants at Chicago and Chattanooga, Tenn. Rumely will supervise the Chicago works and Chattanooga division and will coordinate manufacturing operations in the plants of the company's subsidiaries.

Rumely, a Crane director and vice president, joined the company in 1937 and became works manager in 1938 and vice president—manufacturing in 1941. Blugerman was named executive assistant of Crane Company in 1952.

Federal Fawick Corporation Announces Two Promotions

John V. Eakin has been appointed general manager of Fawick Airflex Division, Federal Fawick Corporation, and Theodore E. Metz appointed advertising manager of Federal Fawick Corporation.

Eakin has been with the company since 1943 and formerly was assistant general manager, sales manager, and southwestern district manager. In his new position he will be responsible for the direction of Fawick Airflex Division, manufacturers of industrial clutches and brakes and related products.

Metz has been the advertising manager of Fawick Airflex Division and of the Fawick Airflex Company prior to the merger of Fawick and Federal Motor Truck Company, Detroit. He has been with Fawick since 1948, having previously been a member of the Sales department. Metz will be responsible for the administration of advertising and sales promotion for the corporation: Fawick Airflex Division; Fawick Brake Division, Detroit, and Federal Motor Truck Division.

D. R. Dale Retires from Service As S. M. Jones Company Engineer

D. R. (Dick) Dale, for many years chief engineer-metallurgist of The S. M. Jones Company, retired from service with the company in March. Dale joined the firm in 1911 as assistant superintendent, later became superintendent and then chief engineer-metallurgist.

Dale has been a member of the American Society of Metals for 30 years and of the American Petroleum Institute since its founding. He has been responsible for developments and improvements in sucker rod design, manufacture and metallurgy and assembled a collection of types of sucker rods which will be displayed at the International Petroleum Exposition in Tulsa.

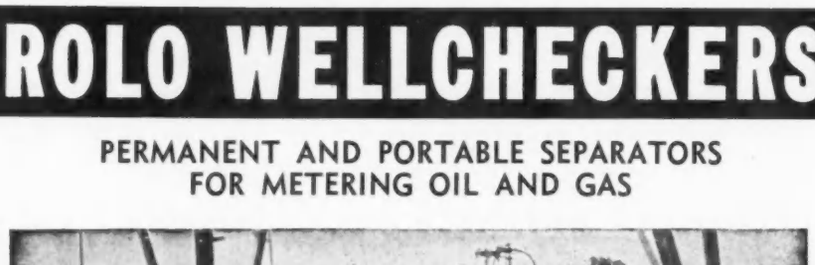
Slush Pump RODS & LINERS—

In all stock sizes or to your order.

JP
J. P. MACHINE & TOOL COMPANY
1534 S. E. 29th St.,
MElrose 8-8700
Oklahoma City, Okla.
OIL FIELD SPECIALTY ITEMS

ROLO WELLCHECKERS

PERMANENT AND PORTABLE SEPARATORS FOR METERING OIL AND GAS



Field installation of trailer-mounted Rolo Wellchecker No. IH-2406

Made in various sizes to fit any operation, Rolo Wellcheckers are shipped completely piped and ready to operate. You need only connect inlet and outlet. In addition to oil meter, B. S. & W. sampler, gas run, orifice meter, fittings and all controls, free water knockout with meter can be furnished to separate and continuously remove free water from well fluid. See Composite Catalog or write for illustrated Bulletin 1951-W.

Crude Oil Metering Specialists

ROLO MANUFACTURING COMPANY
P. O. BOX 6/63, HOUSTON 5, TEXAS
BRANCHES: Corpus Christi, Midland, Kilgore, Tulsa, New Orleans, Los Angeles, Bakersfield, Casper, Calgary, (Alta.)
Petroleum Industry Consultants, Apartado 3992, Caracas, Venezuela
EXPORT OFFICE: R. S. Stokvis & Sons, Inc., 17 Battery Place, New York, N. Y.

Myron W. Rhoten

Clyde Crozier

M. W. Rhoten to European Area for Allis-Chalmers

Myron W. Rhoten has been named territory sales manager for the European area, Tractor Division, Allis-Chalmers Manufacturing Company, Milwaukee, Wis., and Clyde Crozier has been designated to succeed Rhoten as export service manager in the home office.

Walter A. Hebeler

Rhoten succeeds George A. Gillespie, recently appointed resident manager of the Paris, France, office.

Rhoten was with the Allis-Chalmers dealer at El Point, S. D., prior to joining the company at Sioux City, Iowa, in 1938. Later he was transferred to the Madison, Wis., branch and then to the home office in 1941. Crozier joined the company in 1941 in Los Angeles as service representative and manager.

Walter A. Hebeler has been appointed to the new position of export sales manager of the Tractor Division of Allis-Chalmers to assist F. J. Mischke, manager of the Export department. Hebeler has been a special export representative for the Tractor Division since 1950. He joined the firm in Kansas City in 1933, and served the company in Des Moines, Iowa, and Buenos Aires, Argentina.

Baash-Ross Promotes Nagle To Assistant Export Manager

Paul R. Nagle, formerly sales representative in the Oklahoma City area, has been named assistant export manager by Baash-Ross Tool Company. He will have his headquarters in the New York City office and work under the direction of Kenneth S. Ross, Baash-Ross export manager. Nagle is widely known in the Mid-Continent area where he spent many years in drilling and development operations. He recently has been active in the Oklahoma City area as a member of the Baash-Ross organization. He will assume his new position after a short training period in export procedures at the Baash-Ross executive offices.

P. R. Nagle

Robert H. Pearson Retires From Gardner-Denver Company

Robert H. Pearson, who has been with Gardner-Denver Company for 37 years, has retired as a vice president of the company and moved to Denver to assume management of Air Rentals, Inc., a newly formed organization which will distribute Gardner-Denver equipment and several allied lines of equipment and supplies for mining and construction.

Pearson joined the Denver Rock Drill Company in Denver in 1916 and became associated with the Gardner-Denver organization when the Denver firm merged with Gardner Company in 1927. Pearson left Denver in 1928 for Knoxville, Tenn., to manage the company's branch office and was transferred to the home office in 1930. In 1934 he was named vice president and served as sales manager for construction and oil field equipment until his retirement.

Air Rentals will specialize in equipment and supplies for the rock contractor and quarry operator and for mines.

Southern Engine & Pump Company Opens New Orleans Sales Office

Southern Engine & Pump Company, Houston, has announced the opening of an eighth sales office in New Orleans, La., with the appointment of C. J. (Chuck) Uthoff as representative at that branch.

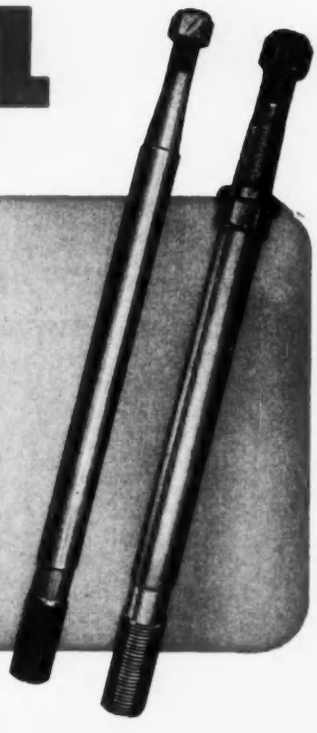
The new office will specialize in the furnishing of nationally-known pumps and engines for the industrial field with accent on aiding the oil industry in its problems.

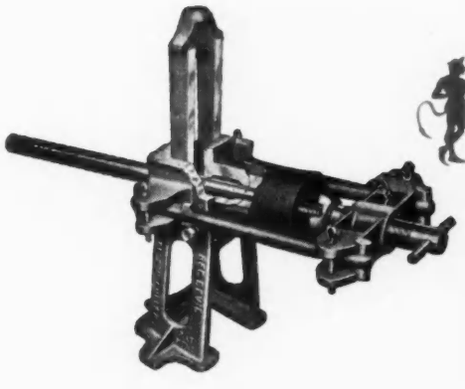
RED DEVIL

"DIA-HARD" PISTON RODS

For high pressure abrasive service

RED DEVIL Piston Rods are first choice where drilling conditions are severest because of the extreme hardness of the deep HIGH-CARBON wear resistant "DIA-HARD" case, coupled with tough core properties which give the highest tensile strength against breakage. All rods are hardness tested and precision gauged to maintain a world-wide reputation for quality. Write for Catalog No. P-101.





RED DEVIL PISTON PULLER

For tapered type rods

The usual practice of removing pistons from rods by blows of a sledge hammer often damages either pistons or rods. A Red Devil piston puller easily and quickly removes badly stuck pistons without injury to either part. All elements are made of finest quality alloy steel, heat-treated for strength and long life. Write for Catalog No. P-106.

RED DEVIL PISTON ROD LOCK NUT

These "Hammer Lug Type" nuts provide a fast and positive means for locking piston rod in crosshead. Made from alloy steel and heat treated, they will last indefinitely. Face of nut is precision machined for full seating surface at right angles to axis of threads to prevent fatigue stresses in rod. Write for Catalog P-102.

Complete information in Composite Catalog or write for price catalogs noted above. Red Devil products are available through your supply store.

OIL WELL MANUFACTURING CORP.

6008 S. Alameda Street, Los Angeles 1, California

A *Blue Ribbon* INSTALLATION...

Pictured below is an installation of 8 Wilson Supply-Ingersoll-Rand "Packaged" Portable Booster Compressors —handling some 6,000,000 cubic feet of gas per day in the Richard King Field in South Texas.

This installation has passed its third year of continuous service—with a minimum of maintenance costs and no loss of time due to complete shut-down.

The operator of this field was one of the first in the industry to see the economies and flexibility possible with "Packaged" Portable Compressor Units over a more permanent installation where close to 1000 H.P. was required.

Careful and complete records of operation and maintenance have been kept by this Producer and results have more than met expectations.

WILSON SUPPLY~INGERSOLL-RAND

Packaged Portable

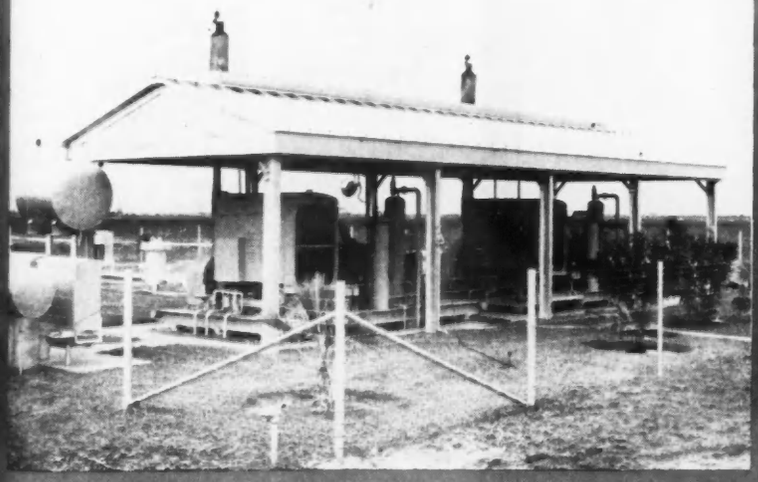
COMPRESSORS

Throughout the Industry Wilson Supply-Ingersoll-Rand "Packaged" Portable Compressors are meeting the specific needs of Producers. For Gas-Lift, Booster work, and Recycling and Repressuring, these Units are proving their leadership through outstanding performance.

The "Know How" of Wilson Supply Company in fabricating these Units means dollars saved to the purchaser in long life and trouble free performance.

Whatever your Compressor needs, remember Wilson Supply-Ingersoll-Rand "Packaged" Portable Compressors are engineered to best do the job.

Contact your nearest Wilson Supply Store or write "Compressor Division," Wilson Supply Company, P. O. Drawer 19, Houston, Texas, for detailed information and quotations. Please give suction and discharge pressure and volume to be handled.



WILSON SUPPLY CO

HOUSTON, TEXAS

1301 Conti St. (Corner of Walnut)
HOUSTON, TEXAS

Branch Stores

TEXAS—Alice, Corpus Christi, Victoria, Bay City, Columbus, Barbers Hill, Liberty, Beaumont, Kilgore, Monahans. LOUISIANA—Lake Charles, New Iberia, Houma, Harvey, Shreveport.

Sales Offices

TULSA, OKLAHOMA • DALLAS, TEXAS • NEW ORLEANS, LA. • SHREVEPORT, LA.

all the advantages of

chem lab's

specialized geological experience

in the Rocky Mountain area

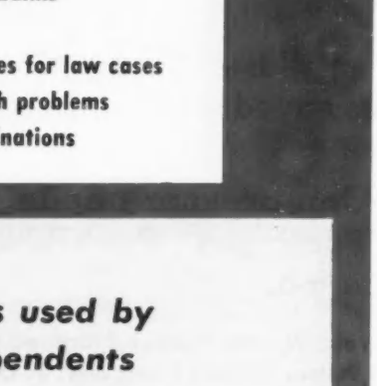
are available for

- stratigraphic well logging
- sedimentary analysis of cores
- supervision of well drilling
- reservoir analysis both for operators and banks
- consulting
- expert witnesses for law cases
- special research problems
- sample determinations

Monthly stratigraphic well logging service is used by both majors and independents

The Geological Department's most important service is in stratigraphic well logging. This monthly service is used by almost all of the major operators, and many independents, in the Rocky Mtn. Area.

This service has resulted in the accumulation of a wealth of subsurface data — data which is extremely valuable to older companies that already have obtained other data, as well as the new companies that are just starting to gather information in this area. The many advantages of this experience and data are also available to anyone interested in an individual log.



SEE CHEM LAB

for fully integrated chemical, engineering, geological and map services.

CHEMICAL & GEOLOGICAL LABORATORIES

Laboratories at Casper, Midland, Glendive and Edmonton

Blaydes Named Sales Engineer For Welex Jet Services, Inc.

Welex Jet Services, Inc. has announced the association of J. J. Blaydes as division sales engineer of the Gulf Coast Division under J. B. Fleming, division manager. Blaydes was employed by Halliburton Oil Well Cementing Company from 1939 until 1948. Also he was assistant general superintendent with Spartan Tool and Service Company, Houston, and district sales engineer for Baker Oil Tools. In his new position, Blaydes will work throughout the Gulf Coast area.

J. J. Blaydes

Borg-Warner Corp. Names Three New Vice Presidents

A major reorganization of the top executive staff of Borg-Warner Corp. was announced with the naming of three vice presidents. L. G. Porter, treasurer, becomes administrative vice president and treasurer; R. S. Ingersoll, president of the Ingersoll Products Division, was elevated to an administrative vice presidency of the parent corporation; and Robert W. Murphy, general counsel, was elected vice president and general counsel. In addition to other executive duties to be assigned to him, Murphy will continue to head the Legal department of Borg-Warner.

The administrative vice presidents, Porter and Ingersoll, assume executive supervision of a group of divisions and subsidiaries within the corporation. Ingersoll will retain the presidency of the Ingersoll Products Division, Reflectal Corp. and the Petro-Mechanics Research Division.

National Supply Announces Appointment of Managers

J. C. Woods has been appointed division sales manager and C. J. Stubble division tubular manager of the Eastern Division of The National Supply Company. Both have served as assistant managers of that division since 1950.

Woods joined National Supply in 1944 in Fort Worth, Texas. For the present he will maintain headquarters at Toledo, Ohio, where he has been since 1950. Woods will handle special sales activities in Chicago, St. Louis, Findlay and Cleveland, pending a reallocation of these responsibilities.

Stubble joined the company in 1934 at Bolivar, N. Y. He continues to have headquarters in Pittsburgh where, in addition to his new responsibilities, Stubble will supervise sales of well head equipment manufactured by the company's Houston plant.

Rockwell Appoints Johnson Manager of Atlanta Office

R. A. Johnson has been appointed Atlanta district sales manager of Rockwell Manufacturing Company. The Atlanta office is responsible for the southeastern states. Johnson, a graduate of the University of Pittsburgh, joined Rockwell in 1939. He has been a sales engineer in North Carolina and Virginia, and most recently served as assistant sales manager of liquefied petroleum gas products.

New Magcobar Office Opened In Rocky Mountain Area

Magnet Cove Barium Corp. has opened a Rocky Mountain area office in Denver, Colo., with E. K. Lane as assistant manager in charge. Lane joined Magcobar as their oil emulsion representative in 1948. His experience includes a number of years with Shell Oil Company and Byron Jackson. Lane organized Oilfield Machine & Supply Company and served as president until he resigned to join Halliburton Oil Well Cementing Company.

E. K. Lane

Aero Service Establishes Subsidiary Mapping Company

Establishment of a subsidiary company at Salt Lake City, Utah, to serve expanding mapping requirements in the West, has been announced by Aero Service Corporation of Philadelphia, worldwide aerial mapping company. The subsidiary, Aero Service Corporation (Western), will compile topographic maps and photomaps for oil and mining companies in the west and produce maps for highways, cities, flood control, irrigation studies and other engineering uses.

Winton Named to New Post With U. S. Rubber Company

Harold M. Winton, training director for the mechanical goods division, United States Rubber Company, has been named to the newly created post of sales development manager. Winton has been with U. S. Rubber since 1946 when he joined the Sales Training department of the tire division. In 1950 he was appointed director of personnel and training for the mechanical goods division, where he became responsible for development programs for training in sales and production.

Winton's new duties will include development and preparation of materials and programs to increase the effectiveness of the branch and commodity sales organization.

Security Engineering Appoints Crawford Division Manager

Roland O. Crawford has been named Rocky Mountain Division sales manager for Security Engineering Division, Dresser Operations, Inc. Crawford has been connected with the oil industry and sale of oil field equipment since 1939. He joined Security in 1946 and worked in the Rocky Mountain, Illinois, California and Texas areas.

Roland O. Crawford

Crawford attended the School of Mines of South Dakota and the University of Wyoming after which he served five years during World War II in the U. S. Army Engineers.

chem lab's

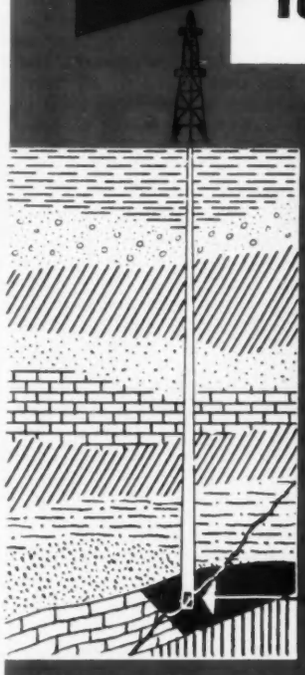
full diameter corestudy

gives

- truer
- more representative
- more realistic

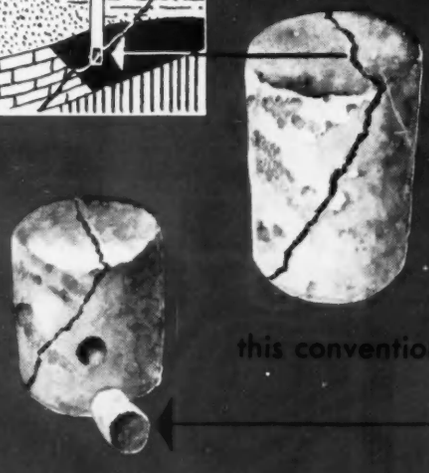
information for

- wildcat completion
- reservoir information



for example

this Full Diameter Core can measure the effect of *fractures...*



this conventional plug *cannot*

HERE'S PROOF FROM THE FILES

TYPE OF PRODUCING FORMATION: LIMESTONE

METHOD OF ANALYSIS	CONVENTIONAL PLUG	FULL DIAM. CORESTUDY
Footage analyzed	39	39
Specimens analyzed	39	39
Total porosity—feet	187	251
Total millidarcy—feet	17	6,591
Footage of 0.1 millidarcy & higher	13	20
Total volume of specimen analyzed in cu. in.	17	2,172
Cost of analysis (porosity and permeability)	$156.00	$254.00

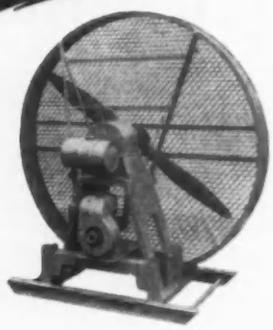
Result: **Full Diameter Corestudy analyzed 40 times more volume of specimen at less than $100 additional cost.**

SEE CHEM LAB for fully integrated chemical, geological, engineering and map services

CHEMICAL & GEOLOGICAL LABORATORIES

Laboratories at Casper, Midland, Glendive and Edmonton

Bugs and Business DON'T MIX!



Ever try to stab a joint or run a spinning line while a stink bug crawled up the back of your neck?

A BEMCO Bug Blower would have prevented your predicament. The baby hurricane created by its 66" airplane type blade would have taken that varmint away from there, and what's more kept the entire floor bug-free.

Think back to your stink bug . . . and then remember to order a BEMCO Bug Blower today. One on each of your rigs will keep the bugs out of your business.

L&H MACHINE WORKS
2205 Quitman Houston, Texas
EXPORT Baird Supply Co., Inc
420 Lexington Ave., New York, N. Y.

William T. Box Elected President of BJ Service

William T. Box has been elected vice president—operations and development of BJ Service, Inc. A graduate of Santa Clara University where he received his mechanical engineering degree in 1940, Box joined the Service Division of Byron Jackson Co. the same year, later becoming engineer in charge of the jet perforation research and development. Box transferred to BJ Service Inc., a subsidiary of Byron Jackson in May, 1952. He has been assistant to John B. Merritt, executive vice president.

Moody Heads Allis-Chalmers New Rocky Mountain Office

Allis-Chalmers Manufacturing Company has combined the district and branch office territories of Denver, Salt Lake City, Phoenix, El Paso and Spokane into the Rocky Mountain Region with headquarters in Denver. Richard D. Moody, manager of the Los Angeles office since 1950, has been appointed manager of the new region. Moody, a graduate of the Colorado School of Mines, has been with A-C since 1938. Richard L. Engel succeeds Moody as manager of the Los Angeles district office.

G-E Welding Distributor Named in Louisiana

Consolidated Welding Supplies, Inc., New Orleans, La., has been named General Electric welding distributor for the New Orleans-Baton Rouge area.

The company, which will handle the complete line of G-E welders, electrodes and accessories, is managed by C. A. Young, Jr. and W. G. Blackwell.

Bentley New Sales Manager Of GM's Detroit Diesel Division

Ernest F. Bentley has been named general sales manager of the Detroit Diesel Division of General Motors. He succeeds the late V. C. Genn.

E. F. Bentley

Bentley joined GM in 1934 as an engine designer with the Winton Engine Corporation of Cleveland, Ohio, which later became Cleveland Diesel Engine Division. He went to Detroit Diesel in 1940 as project engineer and prior to his present appointment was operations sales manager. Other appointments announced by Bentley, include Robert V. Baxley, as operations sales manager; John C. Campbell, as manager of manufacturers' sales and Louis A. Steele, as industrial sales manager.

Bovaird Supply Company Opens Sales Office in Houston

The opening of a sales office of Bovaird Supply Company in Houston brings the number of offices and stores of the company in Oklahoma, Texas, Kansas, Illinois and New Mexico to 23.

The Houston office is under the direction of O. C. King, who has 30 years experience in the oil well supply business. Other Texas offices and stores are located in Borger, Dallas, Midland, Odessa and Snyder.

SECONDARY MODERN RECOVERY
TECHNICAL CONSULTING
PRODUCTION ENGINEERING
SERVICE, INCLUDING
CORE ANALYSIS

PRESSURE MAINTENANCE WITH GAS OR WATER

Salt Water Filter for Strawn Sand Pressure Maintenance

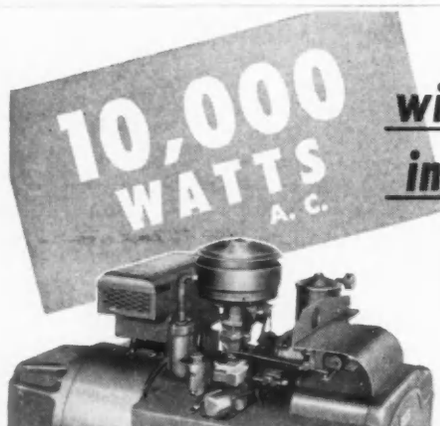
Archer County, Texas

REPRESSURING WITH GAS OR WATER

SURVEYS
ESTIMATES
DESIGN
INSTALLATION
SUPERVISION

PETROLEUM ENGINEERS
CABLE ENGINEERING
WICHITA FALLS, TEXAS

10,000 WATTS A.C.



with half the weight!
in half the space!

the New ONAN "10 CW" ELECTRIC PLANT

Lowest cost complete plant!

You can't match it anywhere in performance, equipment or value. The sensational new Onan *10CW* has everything you've wanted in an electric plant plus exceptional mobility for a plant of its capacity.

On large construction jobs where wattage requirements for power tools are high or where floodlighting of extensive work areas is essential, the Onan *10CW* delivers all the electric power you need.

Before you buy another electric plant for any purpose, take a good look at this new low-cost powerhouse! Also available in 5,000-watt capacity.

★ Twin-cylinder, 4-cycle, horizontally-opposed, air-cooled engine
★ Extra-large, replaceable bearings
★ Full-pressure lubrication
★ High-tension magneto ignition
★ Extremely quiet-running
★ Completely equipped, ready to run

Write for detailed specifications.

Onan ELECTRIC PLANTS
D. W. ONAN & SONS INC.
5978 University Ave. S.E., Minneapolis 14, Minnesota

John Pritchett

Walt Baum

American Iron & Machine Works Adds Two in Sales Department

American Iron and Machine Works Company of Oklahoma City has added two men to its sales force. Walt Baum will be located in Oklahoma City and will specialize in the sale of production equipment. Baum has been with American Iron since 1944 when he joined the company as a shipping clerk in Oklahoma City. He served as manager of the Houston office and American Iron Rental Yard. For the past four years he has been manager of American Iron Pipe Yard in Oklahoma City.

John Pritchett will represent American Iron in the Williston Basin area with headquarters at Williston, N. D. Before joining the sales force, Pritchett worked in the American Iron Shop as a machinist. He later was made maintenance foreman.

Westinghouse Air Brake Buys R. G. LeTourneau Business

Westinghouse Air Brake Company has purchased the earth-moving and related business of R. G. LeTourneau, Inc., including all fixed assets and machinery at Peoria, Ill., Toccoa, Ga., and its interest in the Australian subsidiary for approximately $19,500,000.

The new business will be operated as the LeTourneau-Westinghouse Company, a subsidiary of Westinghouse Air Brake. No change in personnel is contemplated. LeTourneau will devote part of his time to LeTourneau-Westinghouse as a consultant on development and research work in this field.

The Vicksburg, Miss., and Longview, Texas, plants will remain with R. G. LeTourneau, Inc., which will continue to operate them and manufacture special products for the U. S. Government, and clearing equipment, cranes and other products not related to earth-moving.

Waukesha Sales and Service To Distribute Kohler Line

Waukesha Sales and Service, Inc. has been appointed a distributor for Kohler electrical plants and engines. A complete line of Kohler engines and repair and replacement parts are available at all Waukesha Sales and Service Inc. branches in Texas, New Mexico, and northern and western Louisiana.

Black, Sivalls & Bryson Appoints Sales Manager

Paul Bartley has been appointed Lafayette district sales manager for Black, Sivalls & Bryson, Inc. Bartley has been with the company 15 years, serving as branch manager and assistant regional manager. In his new capacity, Bartley has supervision of sales and service activities of the Oilfield Division in the Lafayette sales district.

Miller Printing Machinery Buys Kerotest Manufacturing

The Miller Printing Machinery Co. of Pittsburgh has announced the purchase of the Kerotest Manufacturing Company, Pittsburgh. All Kerotest preferred and common stock has been acquired by the Miller Company.

Since 1903 the Miller Company has been in the graphic arts field. The company manufactured automatic cylinder letterpresses since 1926. In 1952 the company purchased the Electric Boat Company's Printing Machinery Division at Groton, Conn. and the company is now building offset presses in its Pittsburgh plant.

R. B. Tullis, president of Miller, announced that Kerotest will be operated as a separate company with a few executives of the Miller Company acting in an advisory capacity. Kerotest was incorporated in 1909 as the Pittsburgh Reinforced Brazing and Machine Company and in 1914 began the manufacture of high pressure valves. The title was changed to Kerotest Manufacturing Company in 1927.

Trailmobile Inc. Names Martin New General Service Manager

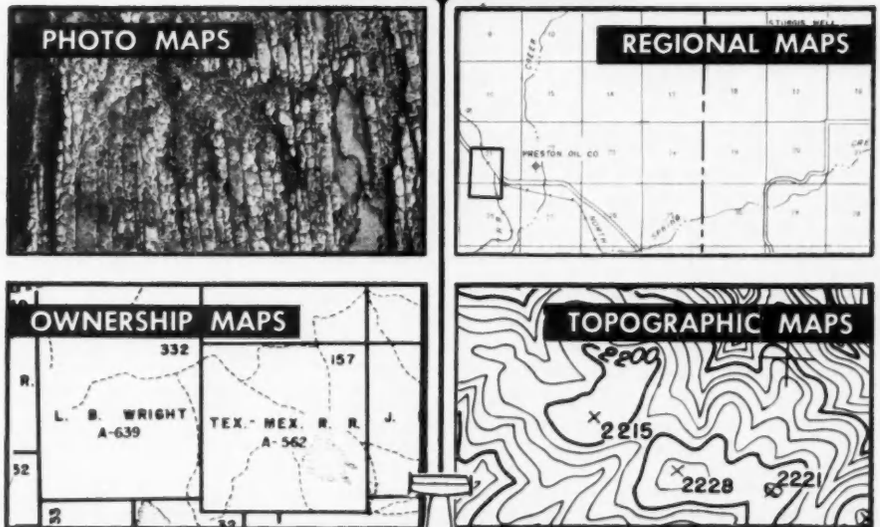
George Martin of Toledo, Ohio, has been named general service manager of Trailmobile Inc. Martin, a native of Winnipeg, Manitoba, comes to Trailmobile from Willys-Overland Motors, where he was general parts and service manager. Trailmobile headquarters are in Cincinnati, Ohio.

TO SPEED FOREIGN AND DOMESTIC EXPLORATION

TO PLAN OIL FIELD DEVELOPMENT AND PIPE LINE LOCATION

Count on Jack Ammann Photogrammetric Engineers for Accurate, Dependable Maps at Reasonable Prices.

AIR PHOTOGRAPHY



Immediately available are maps of thousands of square miles in Montana, Wyoming, South Dakota, Utah, Nevada, New Mexico, Texas, Louisiana, Mississippi and Alabama.

Complete facilities are available for new work. Everything, including planes, field crews, engineers, photogrammetrists, draftsmen and all other needed personnel are ready for any domestic or foreign job.

Jack Ammann

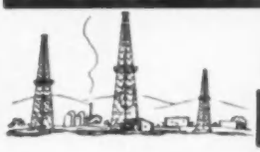
PHOTOGRAMMETRIC ENGINEERS

BROADWAY AT TENTH · SAN ANTONIO 5, TEXAS

AIR SURVEYS—MAPS

Eastern Office: 32 Hillcrest • P. O. Box 411 • Phone Manhasset 7-1840 • Manhasset, N. Y.

WORLD OIL'S Trading Post



CLASSIFIED ADVERTISING

RATES: Regular Classified (undisplayed) set in this size type: 12 cents per word. Minimum charge, $3. Blind box address in our care counts six words. Replies forwarded without charge. **Situation wanted** ads, 6 cents per word. **Display ads**, set in suitably larger type with ruled border, $12 per column inch; situation wanted display ads, $6 per column inch. Ten percent discount for two or more insertions of same copy in consecutive issues. **All classified ads payable in advance. COPY DEADLINE:** 5th of month preceding date of issue. Send copy and checks to: **Trading Post Section, World Oil, P. O. Box 2608, Houston, Texas.**

FOR SALE

■ **TWO 150 horsepower F and T boilers located at Eunice, New Mexico, Makin Drilling Co., Box 131, Hobbs, New Mexico.**

HELP WANTED

■ Division Geologist with Louisiana Gulf Coast region subsurface experience required by sound, substantial company in New Orleans. In reply, please state salary expected and give details of education and experience. Replies confidential. Box 75-W, c/o WORLD OIL, Houston, Texas.

ELECTRICAL AND INSTRUMENT ENGINEER

Responsible for the maintenance and installation of electrical equipment and instruments in a complete refinery of an independent oil company located in the southwest. Must have a degree in electrical engineering and at least 5 years experience in a refinery. Will assist Chief Engineer in developing specifications for electrical equipment and instruments. Will supervise the installation and maintenance of same. Salary open subject to experience and qualifications. Box 95W, c/o World Oil, Houston, Texas.

Wanted

CHIEF GEOLOGIST

for

AGGRESSIVE INDEPENDENT OIL COMPANY

Operating in Rocky Mountain Area, Midcontinent, North and West Texas. Experience in these areas desirable. Give complete details of education and experience by letter in duplicate. All replies held confidential. Box 96-W, c/o World Oil, Houston, Texas.

BUSINESS OPPORTUNITIES

WILLISTON BASIN ROYALTIES

Dealers in Montana royalties since 1921, we now specialize in royalties under major company leases in the Montana portion of the Williston Basin. For information on our method of operation, write LANDOWNERS ROYALTIES COMPANY, Box 1225, Great Falls, Montana.

■ **Hamilton & Hamilton, Inc. and Associated Companies, Northern Petroleum Company and Petroleum Acreage, Inc., have producing and semi-proven oil and gas leases in Montana, to sell or sub-lease to reliable parties on working agreement basis. Write for information: P. O. Box 1605, Room 535 Ford Bldg., Great Falls, Montana.**

■ WILL TRADE wheat land located in Colorado for drilling equipment. Write, phone—875, or wire, Geo. L. Aycock, Jr., Guymon, Oklahoma.

SITUATIONS WANTED

■ Experienced in land and contact work and well-sitting. Desire connection with drilling or oil company, or selling in related fields. Free to travel. Box 9071, Arlington Heights Station, Fort Worth, Texas.

Drilling contractor operating in West Texas and New Mexico desires to contact small or medium-sized independent oil company who needs an operating manager. Personal interview desired. Twenty years experience in all phases of the oil industry. Address replies to Box 94-W, WORLD OIL, Houston 1, Texas.

DECALS

TRUCK LETTERING AND TRADEMARK decals made for your trucks. Easy to apply, uniform, distinctive, economical for small or large needs. Write for Catalog. Mathews Company, 827 S. Harvey, Oak Park, Ill.

MISCELLANEOUS

WANTED—OLD COPIES OF THE COMPOSITE CATALOG

If you have any copies of the 1929, 1930, 1931 or 1932 editions of The Composite Catalog that you do not need we can put them to good usage. Please advise The Librarian, Gulf Publishing Company, P. O. Box 2608, Houston, Texas.

PRINTED FORMS FROM STOCK

Immediate delivery of producing and pipe line forms made from our complete line . . . Write for completely illustrated catalog.

GULF PUBLISHING CO.

P. O. Box 2608 Houston 1, Texas

PUBLICATIONS

■ OUT-OF-PRINT geological publications, U. S. Government series and files of technical journals our specialty. Inquiries welcomed. CANNER'S INC., (Dept. W) Boston 19, Massachusetts.

Lindsay to Handle Exports For Rockwell Manufacturing

Albert G. Lindsay, former manager of Crosley Corporation's Foreign Division, has been named manager of the Export and International Divisions of Rockwell Manufacturing Company. Lindsay was educated in France, Germany and Switzerland and has been engaged in worldwide business for 30 years. For the past six years he has been in business as an American manufacturers' representative and exporter-importer with offices in Argentina, Uruguay and Brazil.

"Oilwell" Makes Two Changes In California Area Staff

Two appointments in the California area have been announced by Donald S. Grubbs, area manager for the Oil Well Supply Division of U. S. Steel.

Rex Malone has been named district representative for "Oilwell" in California and Fred L. Wilkinson was made manager of the Long Beach, Calif., store.

Malone, a graduate of Southwestern University, joined "Oilwell" in 1923 and has since served in various capacities. Prior to his new appointment he was manager of the Long Beach branch.

A native Californian, Wilkinson served two years in the Navy before his employment by "Oilwell" in 1946 as field representative. He succeeds Malone as manager of the Long Beach store.

W. C. Norris Announces Sales Appointments

Changes and additions to the sales force of W. C. Norris, Manufacturer, Inc. include Dan Coates, who has joined the firm as sales engineer with headquarters in Abilene, Texas; Doyle Bain, formerly with Wilson Supply Company, assigned to the Rio Grande Valley territory in South Texas with headquarters in Corpus Christi; and Kenneth Cook, field man at Abilene, Texas, transferred to the Hydraulic department, where he will devote full time to sales and service of Norris hydraulic long stroke pumping units.

Lane-Wells Announces Supervisory Changes

Several supervisory changes in Louisiana, Mississippi and Arkansas have been announced by Lane-Wells Company.

J. G. Parker has been named sub district superintendent at Harvey, La. and transferred from Lake Charles. J. J. Kingrey, formerly at New Iberia, will fill the post in Lake Charles and Kingrey's position as sub district superintendent in New Iberia will be filled by W. R. Smith.

R. D. Fox, readioactivity operator in Natchez replaces Smith as station operator at Laurel, Miss. T. A. Wintz, radioactivity operator in Natchez has been transferred to the Gulf Coast Division office in Houston as division field engineer.

E. T. Robertson of Harvey, La., has been appointed sub district superintendent at Magnolia, Ark.

Joy Manufacturing Company Purchases Barnes and Reinecke

Barnes and Reinecke, Inc., Chicago engineering company, specializing in mechanical research and development, has been acquired by Joy Manufacturing Company, Pittsburgh, maker of mining equipment and industrial products.

Barnes and Reinecke will continue to operate under its present name and with its present personnel as a subsidiary of Joy. The firm's services are mostly in mechanical engineering development, particularly in the automotive field. Barnes and Reinecke also has done important classified work for the government.

Web Wilson Oil Tools Opens Dallas Office

Web Wilson Oil Tools, Inc. has announced the establishment of Mid-Continent headquarters in the Fidelity Union Life Building in Dallas. Ray E. (Flash) Gorman will be Mid-Continent sales manager.

New Books, Maps and Movies

SAUDI ARABIA, Second Edition, Karl S. Twitchell, Princeton University Press, Princeton, N. J. $5.

The author was largely responsible for reporting the vast oil and mineral potentialities of Saudi Arabia and enabling Standard Oil Company of California to secure the right to develop oil reserves there. The book is a survey of the country's physical resources, history and contemporary life. The revised edition brings the facts to date as of mid-1952 and includes a new chapter, "Developments Since 1946."

OIL AND GAS IN THE ROCKIES, Dorsey Hager, J. A. Hogle & Co., 132 South Main Street, Salt Lake City, Utah.

The Statistical and Research Department of J. A. Hogle & Company, members of the New York Stock Exchange, has completed a detailed analysis of oil and gas prospects in the Rocky Mountain region. Dorsey Hager, consulting geologist and writer, prepared the report after making a survey on oil and gas activities including an analysis of the "pays" in Southeastern Idaho, Southwestern Wyoming, Northwestern Colorado and parts of Utah. Free copies are available from J. A. Hogle & Company.

OIL DIRECTORY OF TEXAS, 1953 Edition, R. V. Byram & Company, Drawer M, Capitol Station, Austin, Texas. $10.

The 1953 Directory carries 7,651 listings divided into Oil Producers, Gas Producers, Oil Purchasers, Refineries, Gas Purchasers, Gasoline Plants, Carbon Black Plants, Cycling Plants, and Repressuring Plants. Companies listings include address, telephone numbers, and corporation officers.

API STD. 1104, TENTATIVE STANDARD FOR FIELD WELDING OF PIPE LINES, J. A. McNally, American Petroleum Institute, 50 West 50th Street, New York 20, 50 cents.

This standard was prepared by a formulating committee composed of representatives from the American Gas Association, National Electric Manufacturers Association, Pipe Line Contractors Association, API and other groups. It applies only to crude petroleum and petroleum products trunk lines and to natural gas transmission lines and is designed to insure the production of the highest quality welds obtainable on a commercial basis.

BOUNDARY OF THE PENNSYLVANIAN AND PERMIAN (?) IN THE SUBSURFACE SCURRY REEF, SCURRY COUNTY, TEXAS, Report of Investigations—No. 13, W. A. Heck, K. A. Yenne, and L. G. Henbest, Bureau of Economic Geology, The University of Texas, Austin 12, Texas. 30 cents.

This report on the Scurry reef in Scurry County, Texas will be of interest to geologists concerned with the boundary of Pennsylvanian and Permian formations in that area of the state. The paper is the result of work on a cooperative project between the Bureau and the United States Geological Survey. The paper consists of 15 pages, 5 text figures, and 1 wholetone plate illustrating fusulinids from the Wilshire Oil Company's Lunsford 8 in Scurry County.

INDUSTRIAL WATER ANALYSIS, E. F. Drew & Company, Inc., 15 East 26th Street, New York 10. $1.

This new booklet on industrial water analysis covers in detail, boiler water sampling, expressions of results, test equipment and general water analysis. Special tests for versenate hardness, dissolved oxygen, total solids, steam purity by conductance, and corrosions tested by N.D.H.A. methods are outlined.

PENETRATION CHART OF IMPORTANT OIL AND GAS FIELDS IN WYOMING, Wyoming Geological Association, Petroleum Information, 315 North Wolcott Street, Casper, Wyo. Price on request.

A revised edition of this penetration chart is now available in enlarged form. It covers discoveries in Wyoming since the previous, 1950, edition. In addition many areas which have been proved by one well are shown on the chart even though production has not yet commenced.

AN INTRODUCTION TO THE WILLISTON BASIN. Petroleum Information, 315 North Wolcott, St., Casper, Wyo. $10.

A ready reference digest of the Williston Basin, this book was compiled to provide a comprehensive grounding in matters pertaining to the Williston Basin. Experts in the various fields have contributed articles to the book which represent and reflect background of the industry as well as growth of oil activity in the basin up to 1952. Charts, graphs and maps illustrate the sections on the search for oil, discovery of oil, leasing, recovery and disposition of oil.

OUTLOOK FOR AMERICAN ECONOMY UNDER STABILIZATION Management Report No. 146, Roger L. Putnam, Research Division, California Personnel Management Association, 2190 Milvia Street, Berkeley 4, Cal., $1.

This is an address given before The California Personnel Management Association and the Personnel Section of The Western Management Association by Roger L. Putnam, administrator, Economic Stabilization Agency.

RIGHTS AND DUTIES OF FOREIGN BUSINESS UNDER PERUVIAN LAW, Richard Boesen, *Andean Air Mail* & PERUVIAN TIMES *Publishing Company*, Casilla 531, Lima, Peru $15.

Boesen, formerly of the legal staff of the Allied Chemical & Dye Corporation, New York, and recently admitted to the Peruvian Bar following extended post graduate studies at the University of San Marcos and the Catholic University, Lima, presents an exhaustive analysis in English of Peruvian law relating to business. The book is aimed to clear up problems confronting English speaking business men resident in Peru.

DIRECTORY OF CENTRAL ATLANTIC STATES MANUFACTURERS, 1953 Edition, T. K. Sanderson Organization, Baltimore, Md. $30.

The 1953 Directory lists all Maryland manufacturers alphabetically, geographically and by product classification. Similar listings are made of manufacturers in Delaware, Virginia, West Virginia and the District of Columbia. For the buyer the product section, 120 pages detailing the manufactured items of 10,000 industries, is recommended and for the buyer and seller, the complete directory of five sections.

WAVEFRONT CHARTS AND RAY-PATH PLOTTERS, Albert W. Musgrave, Vol. 47, No. 4, Department of Publications, Colorado School of Mines, Golden, Colo. $1.

This book is concerned principally with the mathematical developments leading to the making of wavefront charts for the assumption of the linear increase of velocity with vertical time and the construction of an electro-mechanical device for computing and drawing the curves. The author is seismic party chief with Magnolia Oil Company, Monahans, Texas.

BAHRAIN, California Texas Oil Company, Ltd., 551 Fifth Avenue, New York 17, N. Y.

The brochure is printed in six colors and contains 80 photographs depicting the life and background of the Middle Eastern people. Equally divided in English and Arabic, the publication is really two booklets in one. The Arabic text reads from the back to front, in accordance with usual Arabic practice. The story of cooperation between the ruler, his adviser and oil men that has produced a picture in today's panorama of overseas oil is told.

OIL—THE INVISIBLE TRAVELER, Shell Oil Company, 1952.

A 16-mm sound film in full color is available without charge to schools, clubs, fraternal organizations and other responsible groups, and carries no advertising or commercial message.

THIS IS OIL, Shell Oil Company, 1952.

The story of petroleum transportation is portrayed in a 16-mm sound film, an industrial film produced by Shell Oil Company and available without charge.

PLANT-CENTERED RECREATION FOR DEFENSE WORKERS—ORGANIZATION AND ADMINISTRATION, National Recreation Association, 315 Fourth Avenue, New York 10, N. Y.

Greater worker efficiency and productiveness on the job are emphasized as by-products of this part of a human relations program in this 40-page booklet. The book's contents are valuable for non-defense plants as well as defense plants. Differences in organization of recreation in large and small plants and characteristics of plant-centered recreation activities are explained.

DRILLING EQUIPMENT MFG. CO.
DEMCO
OKLAHOMA CITY, OKLA. U.S.A.

"NO-CHIP"
TONG
DIES

◄ Genuine Demco Tong Dies have GREEN ENDS!

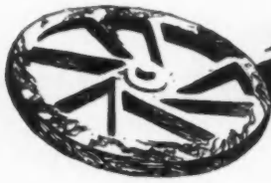
Demco Tong Dies SOFT ENDS WON'T CHIP! ►

Also available in standard tooth

FOR SAFETY'S SAKE always get the original Demco "No Chip" soft end tong dies! They help reduce accidents on the derrick floor. And even on flame hardened surfaces Demco Tong Dies give you maximum gripping power! They're reversible, for longer wear and easy installation!

Sold thru Supply Stores

DRILLING EQUIPMENT MFG. CO.
845 S. E. 29th Street
PHONE 62-4475
OKLAHOMA CITY, OKLA.



SQUEAKS from the BULLWHEEL

New Kind of Man?

"What kind of a fellow is Sam?"

"Well, the other night the lights went out in his girl friend's living room and he spent the rest of the evening fiddling with the fuses."

•

Like Minds

They were huddled together about as close as they could get.

"What are you thinking, my sweet?" he whispered into her mouse-like ear.

"The same thing you are, my darling," she coyly replied.

"Good! I'll race you to the ice box!"

•

Unknown Employe

A mild little man walked into the Internal Revenue collector's office, sat down and beamed on everyone.

"What can we do for you?" asked the collector.

"Nothing, thank you," replied the little man. "I just want to meet the people I'm working for."

•

It Was Like This

A spinster was shocked at the language used by workmen repairing a telephone line near her home, so she wrote the company. The foreman was requested immediately to make a report. The report read as follows:

"Me and Spike were on this job. I was up on the pole and let the hot lead fall on Spike—right down his neck. Spike looked up at me and said: 'Really, Harry, you MUST be more careful.'"

•

Non-Drinker

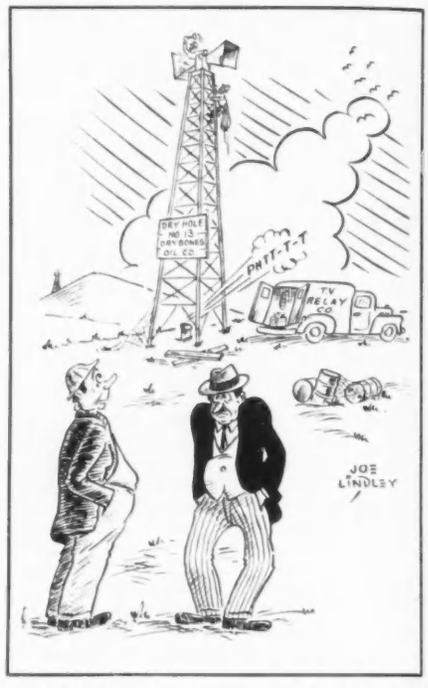
A tool pusher entered a saloon with his wife and six year old boy. He ordered two straight whiskies. "Hey Pa," said the kid, "ain't Ma drinking?"

•

New Title

The movie producer called his staff in for a conference to discuss the new story called 'The Optimist.'

"Gentlemen," he said, "we'll have to change this title to something simpler. Naturally we all know what an optimist is: but will the public know that the hero's an eye doctor?"



"Well, it wasn't a complete loss, Mr. Drybones. I sold the derrick for a television relay tower."

New Mail Box

In Houston a new City Administration recently put out some very fancy garbage or waste paper cans in the downtown district. Citizens thinking that the U. S. Post Office Department had heard about last November's election and had started "prettying things up" mailed 208 letters in the garbage cans before they got their first emptying.

•

Strange Sights

Reporter to window cleaner: In your work you must see many strange sights.

Window Cleaner: Well, I do. Just now up on the fourth floor I saw an office full of people, all working.

L HOTELS
FREE PARKING
COMPLETELY
AIR-CONDITIONED

The small hotels with the big welcome

IN DALLAS
LAKEWOOD HOTEL 1818 Abrams Rd.
LOMA ALTO HOTEL 4518 Lemmon Ave.
LAWN HOTEL 3718 Lemmon Ave.
LYNN HOTEL 3405 Gaston Ave.
In GRAND PRAIRIE
Lennox Hotel N.W. 2nd & Main Sts.
In FORT WORTH
Loring Hotel Camp Bowie Blvd. & University Dr.

Come as you are . . . . . .

What's NEW

In Perforating, Logging, and Fishing Tool Services

McCULLOUGH
NEW SERVICES • NEW TOOLS
NEW WAYS OF DOING THINGS

Latest News About New Tools, Techniques and Services

Do You Have Any of These

Production Problems?

Read how new and improved McCullough M-3 Burrless Bullet and Glass Jet Perforators solve the tough ones

—JOBS SELECTED FROM RECENT McCULLOUGH FIELD REPORTS—

PROBLEM	SOLUTION	RESULT
1. Producing well loses all production. No production even after perforating by other make of jet perforator.	Improved McCullough 2¼" Sectional Burrless Bullet Perforator. Twenty holes shot through the 4½" cemented upset tubing at about 6800 feet. Time one hour and 45 minutes.	**O B/D to 70 B/D**
2. New Well. Very hard chalk formation. Always had to be acidized to make production. Two strings cemented casing—5½" and 7".	Improved McCullough Super Formation Glass Jet Perforator and Steel Strip Carrier. Twenty-five holes shot at about 2100 feet. Time—one hour.	**O B/D to 50 B/D** More production than usual from this formation and without acidizing.
3. Had been perforated with other make perforator, swabbed dry without recovering any oil.	Improved McCullough Standard Glass Jet Perforator and Steel Strip Carrier. Thirty holes shot through 5½", 15½# cemented casing at about 5700 feet. Time—one hour and thirty minutes.	**O B/D to 360 B/D** Best well in field.
4. Well had been shot by other make jet perforator without results.	Improved McCullough 3½" M-3 Burrless Bullet Perforator shot 260 ½" holes at about 10,000 feet. Time—seven hours.	Well surfaced and started flowing in five hours. Production not given.
5. Company engineer wanted well perforated fastest way.	New McCullough Super Casing Glass Jet Perforator with a 50 foot Steel Strip Carrier.	Two hundred holes shot simultaneously in one hour and five minutes —a savings of four hours rig time.
6. New Well. Operator expected top production of 500 B/D.	Improved McCullough 4¼" M-3 Burrless Bullet Perforator. Eight hundred seventy holes shot through 7" cemented casing at about 6000 feet in thirteen hours.	**O B/D to 1000 B/D** A mighty fine well!!

OPERATORS ENTHUSIASTIC OVER RESULTS WITH NEW AND IMPROVED McCULLOUGH PERFORATORS. From field after field, reports are coming in. Unsolicited reports from customers so well pleased they want to tell us about it.

FIND OUT WHAT UP TO 25% DEEPER PENETRATION CAN DO FOR YOU. Call your McCullough Service Engineer and get the facts. Ask him or write today for the new, factual, thirty-two page booklet "HOW TO GET MORE OIL."

PERFORATING, RADIATION LOGGING, AND FISHING TOOL SERVICE—ANYWHERE—ANYTIME.

McCULLOUGH TOOL COMPANY
5820 South Alameda Street, Los Angeles 58, California
405 McCarty Street (P. O. Box 2575) • Houston, Texas
CABLE ADRESS: MACTOOL
EXPORT OFFICE: Los Angeles, California
CANADA: Edmonton, Calgary, Grande Prairie, Alta.; Regina, Saskatchewan
VENEZUELA: United Oilwell Service Co., S.A.; Caracas, Anaco, Maracaibo

SERVICE LOCATIONS: TEXAS: Houston, Snyder, Alice, Cisco, Corpus Christi, McAllen, Odessa, Tyler, San Angelo, Victoria, Wichita Falls, Luling, Beaumont, Sherman, Midkiff, El Campo. **OKLAHOMA:** Oklahoma City, Guymon, Healdton, Hominy. **ARKANSAS:** Magnolia. **MISSISSIPPI:** Laurel. **NEW MEXICO:** Hobbs. **KANSAS:** Great Bend. **WYOMING:** Casper. **CALIFORNIA:** Los Angeles, Avenal, Bakersfield, Ventura. **LOUISIANA:** Houma, Lake Charles, New Iberia, Shreveport. **COLORADO:** Sterling. **NORTH DAKOTA:** Williston. **UTAH:** Vernal.

Operating

SIX POWER RIGS

in Midcontinent Area

☆

Crow

DRILLING COMPANY, INC.

422 Commercial National Bank Building

SHREVEPORT 24, LOUISIANA

CUT STUCK SAND LINES IN THE WELL

KINLEY SAND LINE CUTTER

M. M. Kinley Company Licensees

ABILENE, TEXAS
Hudson-Eads, Inc. - - - - - - - - - - 2-5331
CORPUS CHRISTI
Tubokut Wireline Services - - - - - - 5-1811
Tuboscope - - - - - - - - - - 4-3137, 2-1242
Wireline Specialties Co. - - - - - - 3-2196
HOBBS
Horne Well Service Co. - - - - - - - - 3-5396
HOUSTON
Adair Service Co. - - - - WE-6497, PR-4652
Tuboscope - - - - - - - JU-0577, MO-4279
MIDLAND
Luccous - - - - - - - - - - 4-8471, 4-4320
NEW IBERIA
Tuboscope - - - - - - - - - - 1411, 3210-W
OKLAHOMA CITY
Rainbo Service Co. - ME 4-2131, ME 4-4555
WICHITA FALLS
Hudson-Eads, Inc. - 2-3767, 2-8584, 3-4690

Automatic Dishwasher

"I've got my husband eating out of my hand."

"Saves a lot of dishwashing, doesn't it?"

•

Top Speed

"This model has a top speed of 130 miles an hour, and she'll stop on a dime."

"What happens after that?"

"A little putty knife comes out and scrapes you off the windshield."

•

Modern Age

An elderly farm couple journeyed into town to shop and happened into a home appliance store where they stood transfixed before the latest model electric washing machine, complete with glass door. There in full vision, they watched the wet laundry, soggy and splashing in the demonstrator. Turning to her husband, the little old lady muttered, "Well, if that's television, they can have it."

•

Requiem

A florist phoned a printer, ordering a ribbon for a funeral wreath. "I want it to read 'Rest in Peace' on both sides," he said.

When the ribbon was delivered it read: "Rest in peace on both sides."

•

Good Question!

Father was deep in his easy chair, relaxing after a hard day at the office, Junior, aged 5, was bedeviling him with an endless succession of unanswerable questions.

"Daddy, whatta ya do down at the office?" he finally asked.

"Nothing!" shouted Daddy.

Junior pondered this extraordinary statement for a moment, then: "How d' ya know when you're through?"

•

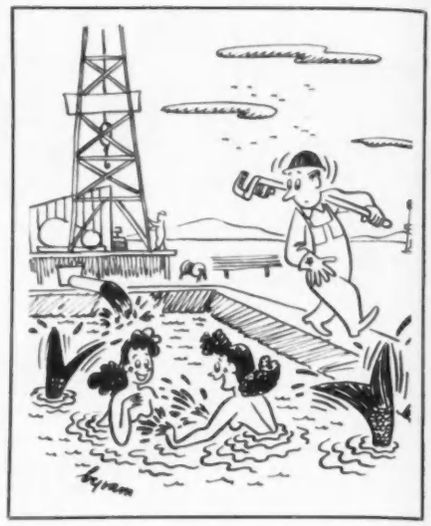
Where Men Are Men

A vivacious young Texan shocked her Boston-reared beau by drawing on her gloves as they started down the street on their first date.

"Where I come from," chided the young man, "people would as soon see a woman put on her stocking in public as her gloves."

"Where I come from," retorted the young lady, "they'd rather."

•



Censorship

Sue was sitting at home peacefully, when there was a knock on the door. Her mother answered, and there stood a soldier with a big bouquet. He said, "Just tell her that the Army censor who's been reading her letters is here in person."

•

Fair Tale

A golfer was playing his first round on a strange course. He made his customary driving swing and missed the ball completely.

"Nice I found this out early," he said. "This course is at least four inches lower than the ones I usually play!"

"It's oil, dear--LANE-WELLS on the job"

CONTRACT CORE IT WITH DIAMONDS

Hard or medium, deep or shallow, you'll recover more core at less cost (fewer trips) with Core Lab's Contract Diamond Coring. No bits to buy. No diamonds to inventory. No barrels and parts problems.

There's a cost-per-foot-cut price established for Core Lab's Contract Diamond Coring in virtually all active areas. (And for Core Analysis, too.) Just call the Core Lab man nearest you. He'll take it from there!

CORE LABORATORIES, INC. ● IN ALL ACTIVE AREAS

Dallas, Houston, Corpus Christi, Midland, Abilene, San Antonio, Tyler, Wichita Falls, Lubbock, Oklahoma City, Ft. Worth, Great Bend, Shreveport, Lafayette, New Orleans, Natchez, Bakersfield, Denver, Sterling, Worland, Williston, Billings, El Dorado, Farmington, Lovington, Calgary, Edmonton, Venezuela, S. A.

CORE 48

★ WELL LOGGING ★
Williston Basin — Rocky Mts.
West Texas — New Mexico
Foreign
Complete Field Laboratories
P. O. Box 1992
Phones: 2-8996 2-9934 2-6185 2-8355
Geological Well Service Co.
(GEO-SERVICE)
WHITE BLDG., ABILENE, TEXAS
Brochure and References on Request

CONTACT YOUR FAVORITE SUPPLY HOUSE
STANDARDIZE ON
PARMACO CASING AND DRIVE SHOES
•
SIZED CORRECTLY
•
PARKERSBURG MACHINE CO. PARMACO PARKERSBURG, W. VA. U.S.A.
The House of Courteous Service

Handbook for Landmen
Price $25.00
A MUST for lease brokers, oil company landmen, scouts, attorneys and titlemen.
Book provides a cross-indexed reference on farmout letters, purchase agreements, inheritance, probate, property execution of leases and deeds, leasing by guardians and executors, adverse possession, prescription, limitation title, payment of rentals, dowry, vacancies, taxes, recording practices, and other related subjects. **MR. M. C. ROWOLD**, the author, has been with Humble Oil & Refining Company 26 years.
Make check payable to author and address envelope to
Broaddus Honeycutt,
11012 Greenbay Drive, Houston 24, Texas

Standco
NO-SMOKE
STANDCO BRAKE LINING
Nothing novel—no bunk, but it gets the job done without scoring brake rims. See pages 4811-4830 Composite Catalog.
Standco Brake Lining Co.
HOUSTON

"Yep, after paying taxes on the net income, we had to give the government a couple of wells to break even."

For Gourmets Only

During a brief stop at a small Southern town, a couple walked to a small lunch counter. There were steaming containers of creamed chicken, spoon bread, pork chops and other tempting dishes.

They ordered chicken.

"Are you from the train?" a motherly attendant asked.

The man nodded.

"No creamed chicken."

"Pork chops?" queried the puzzled patron.

"Not when you're on the train. You folks can have cheese sandwiches. People with only 10 minutes ain't sittin' here to gobble down food I spent all afternoon preparin'! I want folks to dawdle over my food an' appreciate it."

•

Powder Room Etiquette

Mary Ann, an eight-year-old, was invited to spend a week-end with an elderly maiden aunt. "Now, dear," cautioned her mother before she departed, "remember, your Aunt Phoebe is rather strict and very proper. If you want to go to the bathroom, just say, 'I'd like to powder my nose, please'."

Mary Ann's manners were above reproach and when she was saying goodbye her aunt said, "It was nice having you, my dear. Next time perhaps your little sister Judy can come, too."

"Oh, no, Aunt Phoebe," Mary Ann said quickly. "Judy still powders her nose in bed."

•

The Pen and the Tongue

Two rival authoresses met the other day. One had just had a new book published.

First: Darling, I think it's a masterpiece. Who wrote it for you?

Second: I'm so glad you like it. Who read it to you?

•

Ideal Applicant

He was undersized, meek, subdued and had applied for a job as night watchman. "Yes," said the boss, dubiously, "but the fact is we want someone who is restless and uneasy, especially at night. Someone who is always listening, thinking there are bad characters around. We want a large, aggressive, intrepid and dangerous person, bad-tempered and revengeful. In short, the kind of person, who, when aroused, is a fiend.

"All right," said the little man as he walked away. "I'll send my wife."

Propriety

A young lady found herself for a week end with a strait-laced country family in England. Fearing the pajamas she wore instead of a nightgown might be considered improper, she carefully hid them each morning. But one day at breakfast she realized she'd forgotten them and they lay brazenly on her bed. Excusing herself she rushed upstairs. The pajamas were gone.

While hunting for them madly, an elderly maid appeared at the door. "If it's the pajamas you're looking for, miss," she said, "I put them back in the young gentleman's room."

•

Hidden Charm

After a visit to dancing school, one mother advised her small daughter that she should not just dance silently like a totem pole; talking to her partner was also a part of the social picture.

On a later visit, the mother saw that each time the music started, the same little boy tore across the floor, bowed to her daughter, and swept her away to the music.

On the way home, the mother asked why the same lad chose her for every dance.

"Oh, him," her small daughter explained. "I'm telling him a continued murder mystery."

"FOR WANT OF A NAIL . . ."

Kingdoms have been lost because of the lack of minute, special equipment at a critical time.
And so it can be in your business; packings or piston rings that do a specialized job can make the difference between maximum equipment performance or shut downs.
Let our engineers study your packing or piston ring problem and then recommend the right products for your needs.
Write for Complete Information

- Metallic Packings
- Power Piston Rings
- Carbon-Bakelite Liquid Pump & Compressor Piston Rings
- Valve Discs

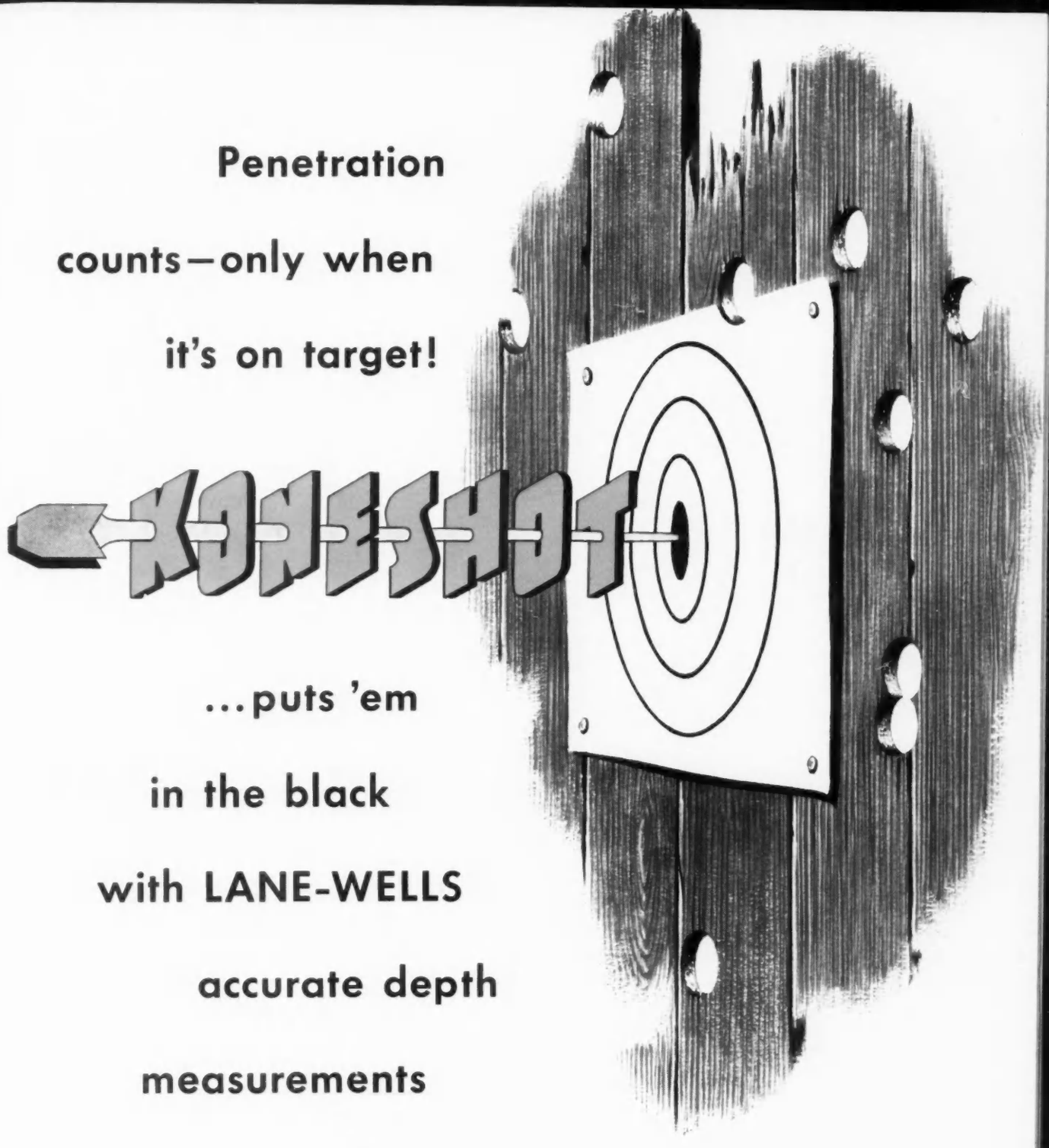
FRANCE PACKING COMPANY
6514 STATE RD., PHILADELPHIA 35, PA.

HOUSTON LABORATORIES
Analytical and Consulting Chemists
Hydrocarbon Gas Analyses, Reservoir Equilibria Studies for Crude and Condensate Well, Waters, Brines, Corrosion and Industrial Analyses.
Phone CApitol 1319, Box 132, Houston, Texas

Penetration

counts—only when

it's on target!



...puts 'em

in the black

with LANE-WELLS

accurate depth

measurements

Fast Service From 71 Branches With Thoroughly Experienced Men

Tomorrow's Tools - Today!

General Offices, Export Office, Plant • 5610 So. Soto St., Los Angeles 58

LANE WELLS

LOS ANGELES • HOUSTON • OKLAHOMA CITY • LANE-WELLS CANADIAN CO. IN CANADA • PETRO-TECH SERVICE CO. IN VENEZUELA

AK-603

Here's why you don't replace tool joints when they are Hughes Flash-Weld

** Drill stems are deliberately failed in the Hughes Laboratory in evaluating field performance of pipe-to-tool-joint connections. Pioneered by Hughes, these tests simulate conditions that cause drill stems to fail in the field.*

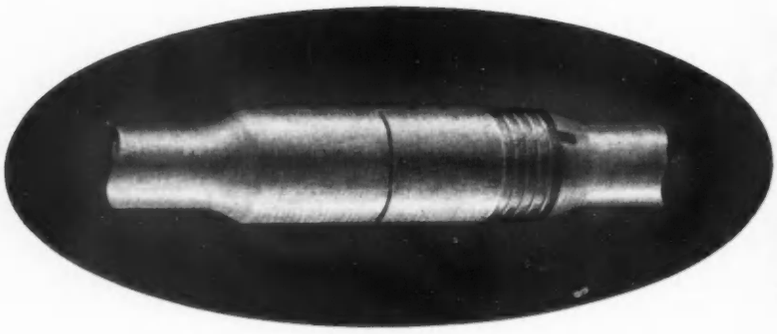
1 HUGHES Flash-Weld Joints are made to last the life of your drill stem . . . eliminating costly tool joint replacements.

2 HUGHES hard-faced Flash-Weld Tool Joints withstand the wear of abrasive formations—and can be *safely* rehard-faced in the field to meet extreme abrasive conditions.

3 HUGHES Flash-Weld Joints have been proved on more than 25,000,000 feet of drill pipe and by 15 years of superior field service.*

4 HUGHES Flash-Weld drill stem is the most dependable drill stem you can run in your well.

5 Cost records show that the cost per foot of hole drilled is lower with HUGHES Flash-Weld drill stem.



FLASH-WELD
A DEVELOPMENT
OF
HUGHES
TOOL COMPANY
HOUSTON, TEXAS

122° 121° 120° 119° 118° 117°

57°

NIG CREEK

NOTIKEWIN RIVER

CLEAR HILLS

BLUEBERRY

BUICK CREEK

DIXONVILLE

CHINOOK

Ft. St. John

Peace River

PEACE RIVER

Peace River

FORT ST JOHN

Hudson Hope

56°

WHITELAW

Fairview

POUCE COUPE

DUNVEGAN

TANGENT

SPRINGBURN

GORDONDALE

Dawson Creek

BELLOY

NORMANDVILLE

EAGLESHAM

HEART RIVER

RYCROFT

WHITEMUD CREEK

SIXTH MERIDIAN

Grande Prairie

STURGEON LAKE

VALLEYVIEW

55°

A L

Smoky River

54°

Athabaska River

COALSPUR

Pembina

53°

Jasper

BRAZEAU

BRITISH COLUMBIA

Nordegg

52°

116° 115° 114° 113° 112° 111°

PEERLESS LAKE
GRAHAM LAKE
McMurray
NORTH WABISKAW LAKE
PELICAN RAPIDS
FIFTH MERIDIAN
LESSER SLAVE LAKE
CALLING LAKE
LAC LA BICHE
Athabaska
ATHABASKA
FLAT LAKE
BOYLE
AMISK LAKE
B E R T A
ROCHESTER
FIGURE LAKE
WESTLOCK
NESTOW
EDWARD
ASHMONT
MELLOWDALE
Westlock
BARRHEAD
ARVILLA
PICARDVILLE
SADDLE LAKE
MAJEAU LAKE
LEGAL
EXCELSIOR
BON ACCORD
SKARO
REDWATER
MORINVILLE
HAIRY HILL
WILLINGDON
DUVERNAY
LAKE ST. ANN
NAMAO
CHIP LAKE
CAMPBELL
ST. ALBERT
FORT SASKATCHEWAN
MUNDARE
Edmonton
BEAVERHILL LAKE
PLAIN LAKE
CHAMBERLAIN
ACHESON-STONY PLAIN
Vegreville
ARMISIE
GOLDEN SPIKE
ELLERSLIE
RANFURLY
WHITEMUD
JOSEPH LAKE
LEDUC-WOODBEND
McLEOD
GLEN PARK
KAVANAGH
ARMENA
WIZARD LAKE
MILLETT
CAMROSE
VIKING-KINSELLA
PIGEON LAKE
BONNIE GLEN
Wetaskiwin
SOUTH CAMROSE
MINNIHIX
WESTEROSE
DUHAMEL
NEW NORWAY
DAYSLAND
SAMSON
MALMO
HOME GLEN
RIMBEY
BASHAW
GULL LAKE
CHIGWELL
ALLIANCE
CLIVE
ALIX
LEA HURST
NEVIS
Stettler
STETTLER
CASTOR
ERSKINE
Red Deer
EWING LAKE
SOUTH STETTLER
RAM RIVER
FENN
HACKETT
NORTH BIG VALLEY
SULLIVAN LAKE
CLEAR WATER
PINE LAKE
BIG VALLEY

112° 111° 110° 109° 108° 107°

McMurray

METHY LAKE

GORDON LAKE

GARSON LAKE

CHURCHILL LAKE

PETER POND LAKE

FOURTH MERIDIAN

WINEFRED LAKE

CANDE LAKE

LAC LA BICHE

PRIMROSE LAKE

COLD LAKE

AMISK LAKE

A

LESSARD

COLD LAKE

FORT KENT

BONNYVILLE

HOLYOKE

EDWARD

ASHMONT

SADDLE LAKE

ST, PAUL

PRIMROSE

HAIRY HILL

ELK POINT

LEA PARK

WILLINGDON

DUVERNAY

MUNDARE

PLAIN LAKE

Vegreville

KITSCOTY

RANFURLY

MANVILLE

Vermilion

BORRADAILE

Lloydminster

VERMILION

LLOYDMINSTER

MAIDSTONE

BATTLEVIEW

LONE ROCK

VIKING-KINSELLA

BAXTER LAKE

WAINWRIGHT

DAYSLAND

BUFFALO LAKE

Wainwright

DINA

CHAUVIN

MANITO LAKE

North Battleford

North Saskatchewan River

ALLIANCE

EAGLE HILLS

UNITY

LEA HURST

Stettler

STETTLER

CASTOR

BULWARK

SOUTH STETTLER

PROVOST

HACKETT

NORTH BIG VALLEY

SULLIVAN LAKE

HEARTS HILL

HAMILTON LAKE

BUFFALO COULEE

S A S K A

WORLD OIL'
WESTERN CANA
OIL AND GAS M

Published as Supplement to

CANADIAN ISSUE

of

WORLD OIL

December, 1953

BUFFALO COULEE

WORLD OI
VESTERN CAN
OIL AND GAS

ublished as Supplement to

CANADIAN ISSUE

of

WORLD OIL

December, 1953

IL'S
NADA
MAP

OIL FIELDS

GAS FIELDS

CRUDE OIL PIPE LINES

NATURAL GAS PIPE LINES

REFINERIES

0 16 32 48 64 80 Miles

101° 100° 99°

MOOSE LAKE

LAKE WINNIPEG

CEDAR LAKE

53°

LAKE WINNIPEGOSIS

RED DEER LAKE

Jct.

SWAN LAKE

52°

N

LAKE MANITOBA

LAKE DAUPHIN

Kamsack

KAMSACK

SECOND MERIDIAN

51°

MANITOBA

Crude Oil and Natural Gas Production of Principal Alberta Fields

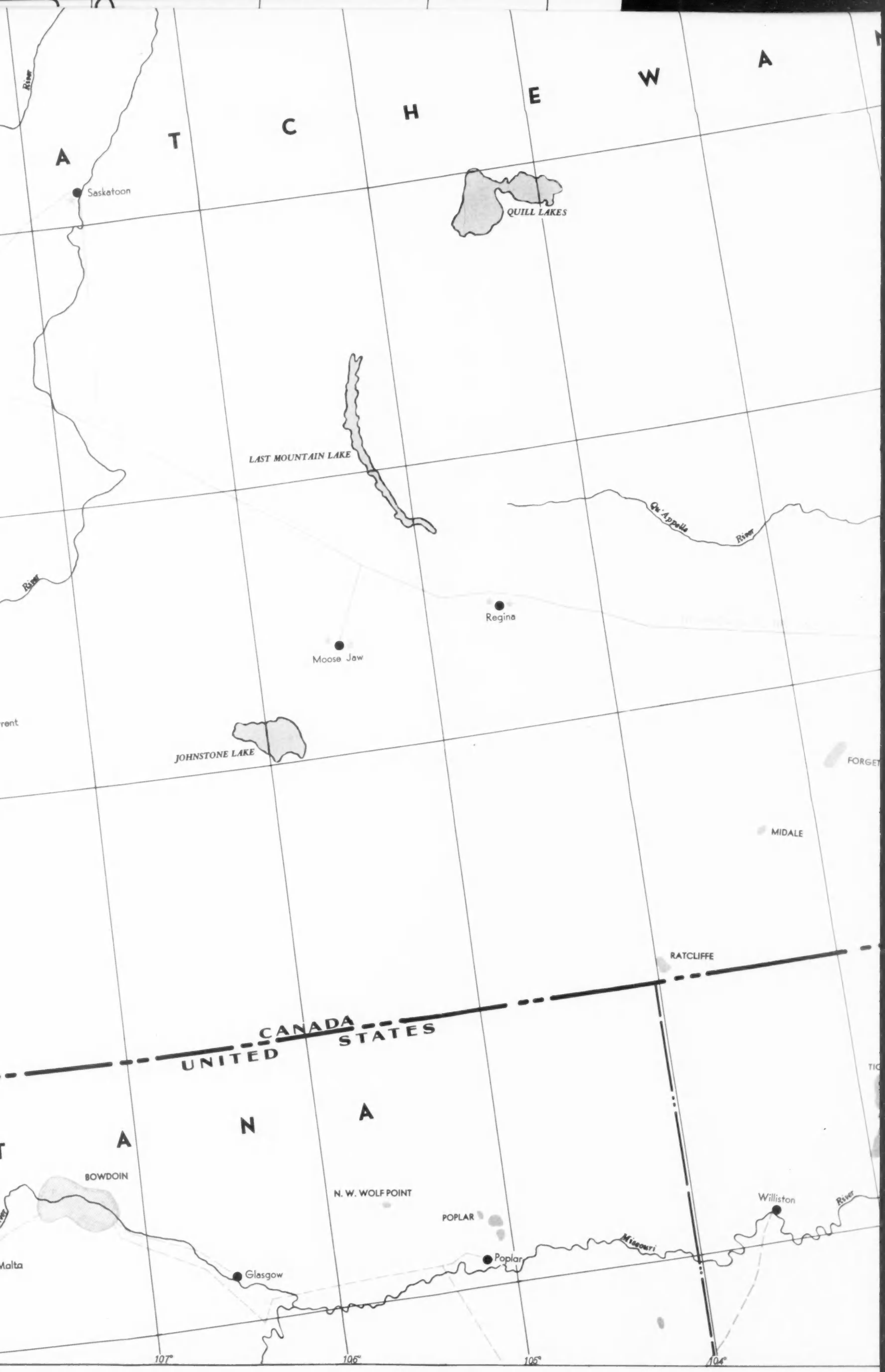
FIELD	CRUDE OIL PRODUCTION (Barrels) During Year 1952	CRUDE OIL PRODUCTION (Barrels) Cumulative to End of 1952	NATURAL GAS PRODUCTION (Thousands of Cubic Feet) During Year 1952	NATURAL GAS PRODUCTION (Thousands of Cubic Feet) Cumulative to End of 1952
Acheson:				
Lower Cretaceous	30,805	54,082	42,077	57,849
D-2 Zone	73,969	73,969	23,921	23,921
D-3 Zone	1,912,081	2,858,355	724,291	1,125,886
Total	2,016,855	2,986,406	790,289	1,207,656
Alliance	16,181	23,452		
Armelgra		462		
Armena-Camrose	1,307,526	1,370,604	349,684	359,510
Armisie	103,594	128,887	46,839	60,959
Athabaska			103,132	439,908
Barrhead		4,857		40,240
Barons	33,693	57,887	6,943	7,153
Bashaw	56,493	67,811	110,195	114,856
Baxter Lake	20,125	22,574	2,195	2,195
Big Valley:				
D-2 Zone	560,021	681,440	205,535	242,545
D-3 Zone	97,854	142,230	42,196	56,446
Total	657,875	823,670	247,731	298,991
Black Butte			1,370,657	1,370,657
Bon Accord	83,526	117,548	2,693	7,397
Bonnie Glen	743,490	743,490	522,087	522,087
Bonnyville	20,871	31,055	74,106	182,435
Bow Island				33,600,000
Brooks			194,786	2,649,759
Campbell	45,650	170,783	72,495	225,292
Clive:				
D-2 Zone	21,527	24,876	4,538	4,538
D-3 Zone	11,925	11,925	6,441	6,441
Total	33,452	36,801	10,979	10,979
Conrad	135,037	1,290,954		
Del Bonita	41,205	137,166	12,000	448,160
Dina	19,694	110,000		
Drumheller:				
Lower Cretaceous	5,417	11,790	56,527	81,268
D-2 Zone	170,271	178,956	57,151	60,426
Total	175,688	190,746	113,678	141,694
Duhamel:				
D-2 Zone	139,710	171,530	58,552	67,091
D-3 Zone	207,430	360,192	58,389	105,149
Total	347,140	531,722	116,941	172,240
Elk Point			242,713	920,386
Ellerslie	44,975	66,319	64,130	90,965
Excelsior	933,644	1,930,451	167,575	332,944
Fenn:				
D-2 Zone	338,218	347,866	155,477	158,271
D-3 Zone	5,548	5,548	12,504	12,504
Total	343,766	353,414	167,981	170,775
Foremost			111,060	5,602,877
Glen Park:				
D-2 Zone	6,512	6,512	9,442	9,442
D-3 Zone	276,207	298,650	146,825	150,627
Total	282,719	305,162	156,267	160,069
Golden Spike:				
D-2 Zone	33,246	42,681	14,667	19,776
D-3 Zone	1,245,857	2,255,348	403,938	715,183
Total	1,279,103	2,298,029	418,605	734,959
Hanna				680
Joseph Lake	998,268	1,930,917	640,044	1,127,430
Jumping Pound	67,257	118,814	7,439,160	13,429,175
Kelsо		955		
Leduc Woodbend:				
Vicking Zone				
Lower Cretaceous	304,784	957,762	226,136	
D-2 Zone	6,772,368	17,707,427	5,053,717	11,8
D-3 Zone	10,768,060	38,231,189	6,187,546	20,9
Total	17,845,212	56,896,378	11,467,399	33,9
Deduct Gas Restored to Formation			—27,544	
Lloydminster	1,057,354	4,553,189	1,192,401	3,9
Malmo:				
Lower Cretaceous	11,786	11,786	7,213	
D-2 Zone	175,871	175,871	88,118	
D-3 Zone	82,817	82,817	42,069	
Total	270,474	270,474	137,400	
Medicine Hat-Redcliff			5,099,750	163,0
Moose Dome		8,977		
Namao	41,333	44,564	26,112	
New Norway:				
D-2 Zone	210,573	219,446	94,315	
D-3 Zone	77,415	89,206	47,119	
Total	287,988	308,652	141,434	1
North Big Valley	74,446	74,446	31,402	
Pekisko				
Pendant d'Oreille			6,785,199	6,7
Pincher Creek	51	29,288	1,952	6
Pouce Coulee			405,880	8
Princess	72,970	875,673	353,604	6,0
Provost		1,673		
Ram River		207		
Range				1,3
Red Coulee		329,851	4,056	3
Redwater	23,975,842	62,729,353	3,318,002	9,2
St. Paul			133,267	5
Skaro	7,026	7,026		
Skiff		8,298		
Smith Coulee			167,982	1
South Camrose	30,799	30,799	3,400	
Spring Coulee	7,271	21,172		
Stettler:				
Lower Cretaceous	14,958	45,417		
D-2 Zone	431,601	992,116	147,799	2
D-3 Zone	160,519	437,536	56,337	1
Total	607,078	1,475,069	204,136	4
Suffield			187,685	1,3
Taber	81,464	1,570,473		1,4
Tilley		14,513	23,179	2
Turner Valley:				
Shallow Zone	2,708	521,605	641,168	11,4
Limestone Zone	2,652,299	103,349,546	31,102,942	1,607,2
Repressured Gas			324,975	18,9
Total	2,655,007	103,871,151	32,069,085	1,637,6
Deduct Input Gas			—1,427,186	—33,6
Vermilion	39,058	1,310,375	405,798	4,0
Viking-Kinsella			17,398,977	188,4
Wainwright	27,850	347,129	377,152	4,0
Whitemud	20,010	117,756	30,441	2
Wizard Lake	1,696,077	1,886,672	813,520	9
Total Other Areas	310,586	463,888	868,264	1,2
Total Alberta	58,915,723	253,097,982	93,747,702	2,098,0

ATURAL GAS
RODUCTION
ands of Cubic Feet)

ng r 2	Cumulative to End of 1952
	597,176
36	545,429
17	11,857,912
46	20,953,104
99	33,955,621
44	−27,544
01	3,954,938
13	7,213
18	88,118
69	42,069
00	137,400
50	163,020,341
12	40,751
5	94,938
9	48,379
4	143,317
2	31,402
	2,985
9	6,785,199
2	600,104
0	889,910
4	6,047,767
	1,320,000
3	353,224
2	9,276,968
	564,574
	167,982
	3,400
	292,611
	156,668
	449,279
	1,302,154
	1,450,944
	202,615
	11,408,288
	1,607,295,814
	18,947,781
	1,637,651,883
	−33,633,614
	4,007,630
	188,450,282
	4,031,666
	242,906
	914,501
	1,288,196
	2,098,059,209

Pembina River
PIGEON LAKE
BONNIE GLEN
Wetaskiwin
MINNIHIX
WESTEROSE
SOUTH CAMROSE
DUHAMEL
NEW NORWAY
DAYSLAND
SAMSON
MALMO
BRAZEAU
HOME GLEN
RIMBEY
Saskatchewan
BASHAW
GULL LAKE
CHIGWELL
ALLIANCE
Nordegg
North
CLIVE
ALIX
LEA HURST
NEVIS
Stettler
STETTLER
CASTOR
BULWA
ERSKINE
Red Deer
EWING LAKE
SOUTH STETTLER
RAM RIVER
FENN
HACKETT
NORTH BIG VALLEY
SULLIVAN LA
CLEAR WATER
PINE LAKE
BIG VALLEY
GARRINGTON
CRAIGMYLE
DELIA
Red Deer River
OLDS
HANNA
Hanna
THREE HILLS
WESTCOTT
NEAPOLIS
TWINING
DRUMHELLER
WEST DRUMHELLER
WINCHELL COULEE
Drumheller
Bow River
KEYSTONE VALLEY
WAYNE
Red Deer River
Banff
CHANCELLOR
JUMPING POUND
Calgary
TORONTO
COUNTESS
PATRICIA
OKOTOKS
PRINCESS
BASSANO
TURNER VALLEY
BROOKS
Brooks
EYREMORE
Bow
Cayley
Nanton
VULCAN
Stavely
ENCHANT
Claresholm
BARONS
TURIN
Oldman River
Granum
GRASS
Barnwell
Coaldale
TABER
Macleod
Lethbridge
Belly River
CONRAD
St. Mary River
PINCHER CREEK
SKIFF
SPRING COULEE
Milk River
DEL BONITA
RED COULEE
BORDER
N. CUT BANK
REAGAN
KEVIN
CUT BANK
SUNBURST
LAKE McDONALD
115°
114°
113°
112°

UTH CAMROSE
EL
RWAY
DAYSLAND
BUFFALO LAKE
WAINWRIGHT
Wainwright
DINA
CHAUVIN
MANITO LAKE
North Battleford
North Saskatchewan
ALLIANCE
EAGLE HILLS
UNITY
LEA HURST
Stettler
STETTLER
CASTOR
BULWARK
SOUTH STETTLER
PROVOST
S A S K
HACKETT
NORTH BIG VALLEY
SULLIVAN LAKE
HEARTS HILL
G VALLEY
HAMILTON LAKE
CRAIGMYLE
BUFFALO COULEE
DELIA
DRIVER
HOOSIER
COLEVILLE
HANNA
Hanna
ST. ELIO
DEWAR
ST. FLORENCE
DRUMHELLER
Drumheller
OYEN
D'ARCY
BROOCK
YOUNGSTOWN
SIBBALD
AYNE
Red Deer River
CESSFORD
CHANCELLOR
EMPRESS
STEVEVILLE
CAVENDISH
TORONTO
ATLEE
STEVEVILLE
COUNTESS
PATRICIA
JENNER
South Saskatchewan River
BASSANO
PRINCESS
BROOKS
RAINY HILLS
Brooks
SUCCESS
EYREMORE
Bow
FOSTERTON
BANTRY-TILLEY
SUFFIELD
MIDWAY
CANTUAR
Swift Current
Suffield
MEDICINE HAT
River
ENCHANT
GULL LAKE
Medicine Hat
TURIN
Oldman River
BOW ISLAND
DUNMORE
GRASSY LAKE
Barnwell
Coaldale
TABER
Lethbridge
ETZIKOM
EASTEND
CONRAD
FOREMOST
PAKOWKI LAKE
MANYBERRIES
SKIFF
RAPDAN
SPRING COULEE
SMITH COULEE
PENDANT d'OREILLE
Milk River
DEL BONITA
RED COULEE
BLACK BUTTE
BORDER
FLAT COULEE
N. CUT BANK
REAGAN
WHITLASH
BEARS DEN
KEVIN
HAYSTACK BUTTE
M O N T
CUT BANK
UTOPIA
Chinook
Harlem
HAVRE
DEVON
SUNBURST
BOXELDER
Milk River
BOWES
Malta
113°
112°
111°
110°
109°
108°


A T C H E W A
Saskatoon
QUILL LAKES
LAST MOUNTAIN LAKE
Qu'Appelle River
Regina
Moose Jaw
JOHNSTONE LAKE
FORGET
MIDALE
RATCLIFFE
CANADA
UNITED STATES
A N A
BOWDOIN
N. W. WOLF POINT
POPLAR
Williston
Missouri River
Poplar
Glasgow
Malta
107°
106°
105°
104°

T C H E W A

QUILL LAKES

LAST MOUNTAIN LAKE

Qu'Appelle River

Regina

Moose Jaw

JOHNSTONE LAKE

MIDALE

RATCLIFFE

UNITED STATES CANADA

N A

N. W. WOLF POINT

POPLAR

Williston

Missouri

Poplar

Glasgow

106°

105°

104°

A

N

LAKE MANITOBA

LAKE DAUPHIN

Kamsack

KAMSACK

SECOND MERIDIAN

51°

MANITOBA

WAPELLA

50°

Brandon

DALY

ROSE LEA

FORGET

TILSTON

MIDALE

LULU LAKE

WESTOVER

WASKADA

49°

NORTH WESTHOPE

NORTHEAST LANDA

WESTHOPE

NORTH DAKOTA

TIOGA

Minot

48°

BEAVER LODGE

HOFFLAND

Williston

River

CHARLSON

KEENE

CROFF

103°

102°

101°

WORLD

COLOM

COLOMBIA

CARIBBEAN SEA
Barranquilla
Cartagena
Riohacha
Caracas
VENEZUELA
Cúcuta
Pto. Berrío
Bucaramanga
Medellín
Quibdó
Manizales
Sogamoso
Ibagué
Bogotá
Palmira
Neiva
Pasto
Florencia
PACIFIC OCEAN
ECUADOR
BRAZIL
PERU
EQUATOR
Magdalena
Cauca
Arauca
Meta
Orinoco
Guaviare
Caquetá
Putumayo
Japurá
Amazon
Legend
OIL FIELDS
150 Miles
150 Kilometers
CARIBBEAN SEA
Sta. Marta
Barranquilla
ATLÁNTICO
Cartagena
Mamonal
Calmar
Magdalena
MAGDALENA
Fundación
Fundación River
Valledupar
Venados
César
EL DIFICIL
Arzeuani River
El Carmen
Plato
El Paso
Shell Group
Coveñas
Sincelejo
Lorica
Magangué
Chinú
El Banco
BOLIVAR
Montería
Mamon
Majagual
La Gloria
El Carmen
Sinú River
SINÚ (Abd.)
San Jorge River
Cauca River
TOTUMAL
International Petroleum
PANAMA
GULF OF DARIEN
Esmeraldas River
Man River
Tigui River
Socony-Vacuum Oil Co.
Pto. Wilches
LA SALINA
CANTAGALLO
Sogamoso
GALÁN
Barrancabermeja
Atrato River
Dabeiba
Nechi River
Cauca River
Shell Group
Yondo Concession
CASABE
LA CIRA
INFANTAS
Iue River
SAN LUIS (Abd.)
COLORADO
LA MUGROSA (Abd.)
Magdalena
ANTIOQUIA
De Mares Concession
PACIFIC
Pto. Berrío
Anzá
Alexandria
Medellin
SANTA

D OIL'S 1953 OIL M

MBIA AND VENEZU

VENE

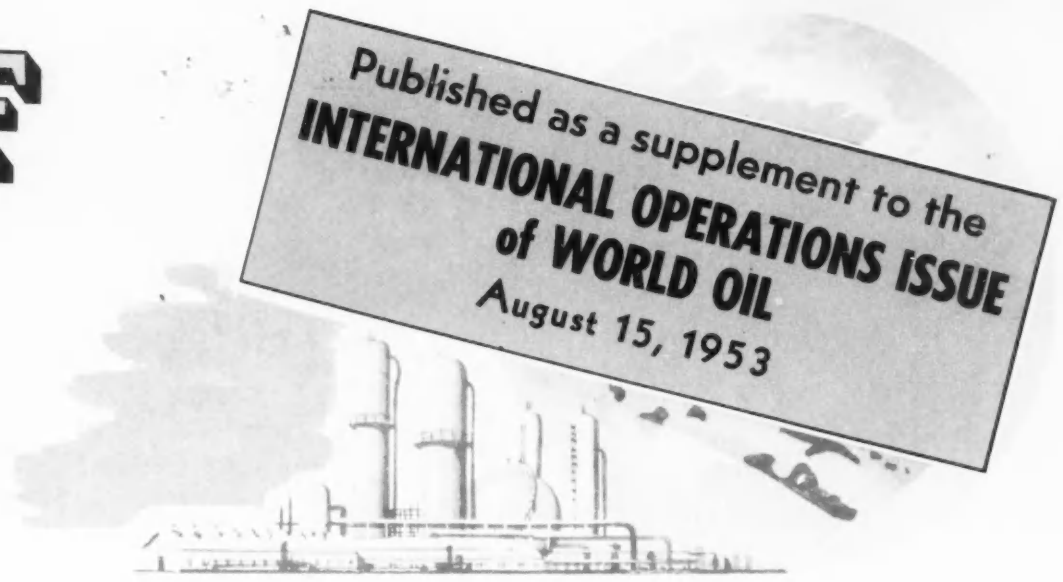
LD OIL'S 1953 OIL MA

OMBIA AND VENEZUE

VENEZUELA

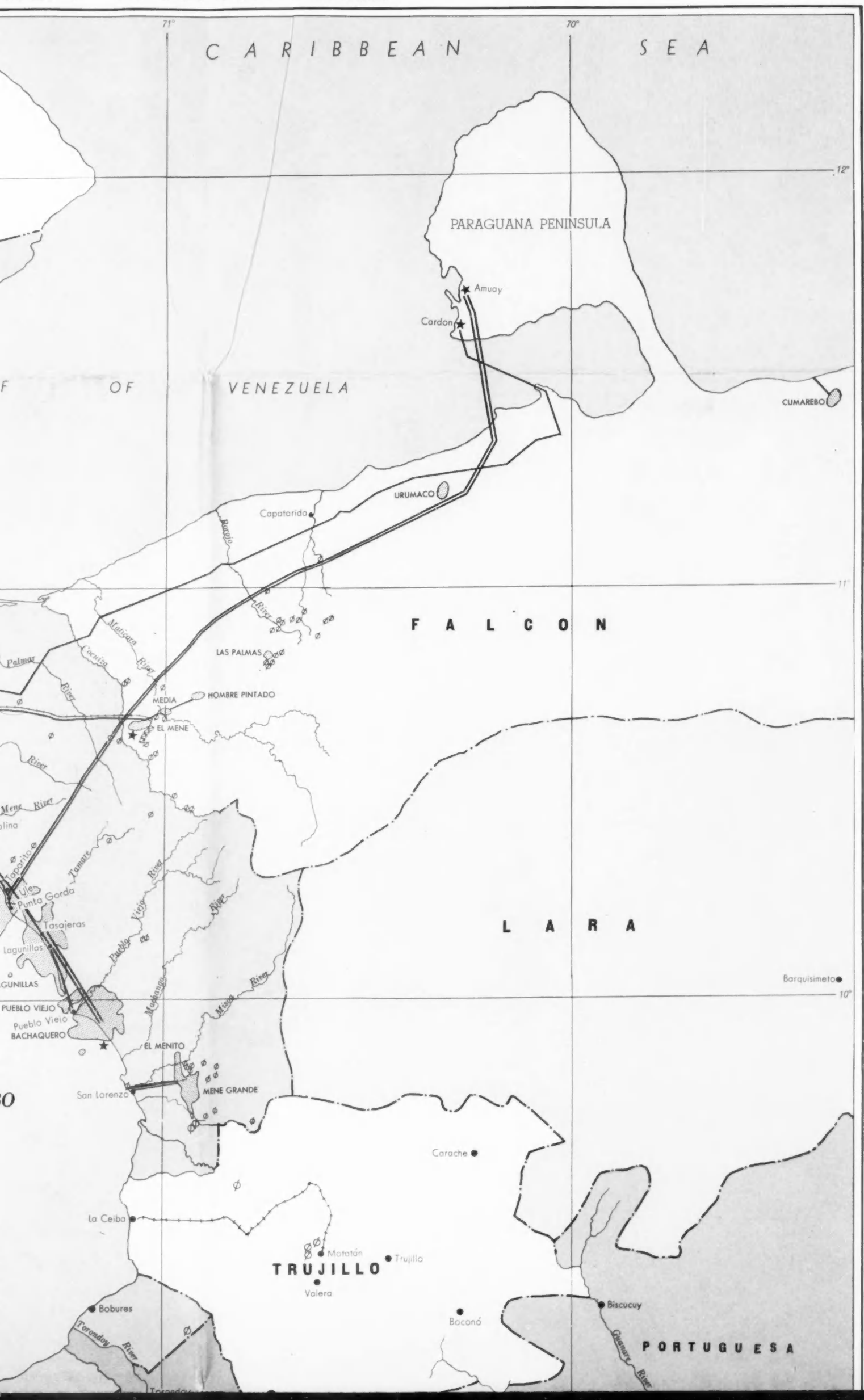
AP OF

UELA



Published as a supplement to the
INTERNATIONAL OPERATIONS ISSUE
of WORLD OIL
August 15, 1953

ELA—Western Fields



PACIFIC OCEAN

ANTIOQUIA

CHOCO

CALDAS

CUNDINAMARCA

TOLIMA

VALLE DEL CAUCA

HUILA

Cauca River

Magdalena River

Tenerife Concession

INFANTAS

COLORADO

SAN [illegible] (A

LA MUGROSA (Abd.)

De Mares Concession

SAN

Pto. Berrío

Alexandria

Medellin

Anzá

VELASQUEZ

Texas Petroleum Co. Private Property

La Dorado

Quibdo

Mainzales

San Juan River

Bogota

Ibaque

Guamo

Buenaventura

Palmira

Cali

7°

5°

77°

75°

ARUBA

CURAÇAO

BONAIRE

CARIBBEAN SEA

Willemstad

Amuay Bay

Pta. Cardón

Coro

URUMACO

CUMAREBO

EL MENE DE ACOSTA

Tucacas

Caracas

Valencia

Catia de la Mar

MARGARITA

Puerto la Cruz

Barcelona

Cumaná

Caripito

TRINIDAD

ATLANTIC OCEAN

NORTHWESTERN OIL FIELDS

Machiques

LAKE MARACAIBO

Trujillo

Guanare

Mérida

Barinas

Santo Domingo

SOUTHWESTERN OIL FIELDS

Cúcuta

San Cristobal

Guasdualito

CENTRAL OIL FIELDS

Placer

El Sombrero

Calabozo

El Lechoso

Valle de la Pascua

Tucupido

Pariaguan

EASTERN OIL FIELDS

Maturin

Maturin

Mapire

Ciudad Bolívar

Orinoco

Apure

Bruzual

San Fernando

Capanaparo

Meta

Orinoco

Caura River

La Paragua

Caroni

Paragua

Guasipati

Tumeremo

BRITISH GUIANA

COLOMBIA

MIRANDA

Uchire

OIL FIELDS

Pipe Lines

Refineries

0 50 150 Miles

0 50 150 Kilometers

70°

65°

60°

10°

ARAGUA

Memo River

Barbacoas

El Sombrero

Macaira River

Chaguaramas

Otoquao River

Las Palmas

TUCUPIDO

TAMAN

Tucupido

Valle de la Pascua

SABAN

RUIZ

LAS MERCEDES

PUNZON

GRICO

GUAVINITA

PALACIO

Orituco River

Manapire River

El Calvario

Las Aceites River

Manapire River

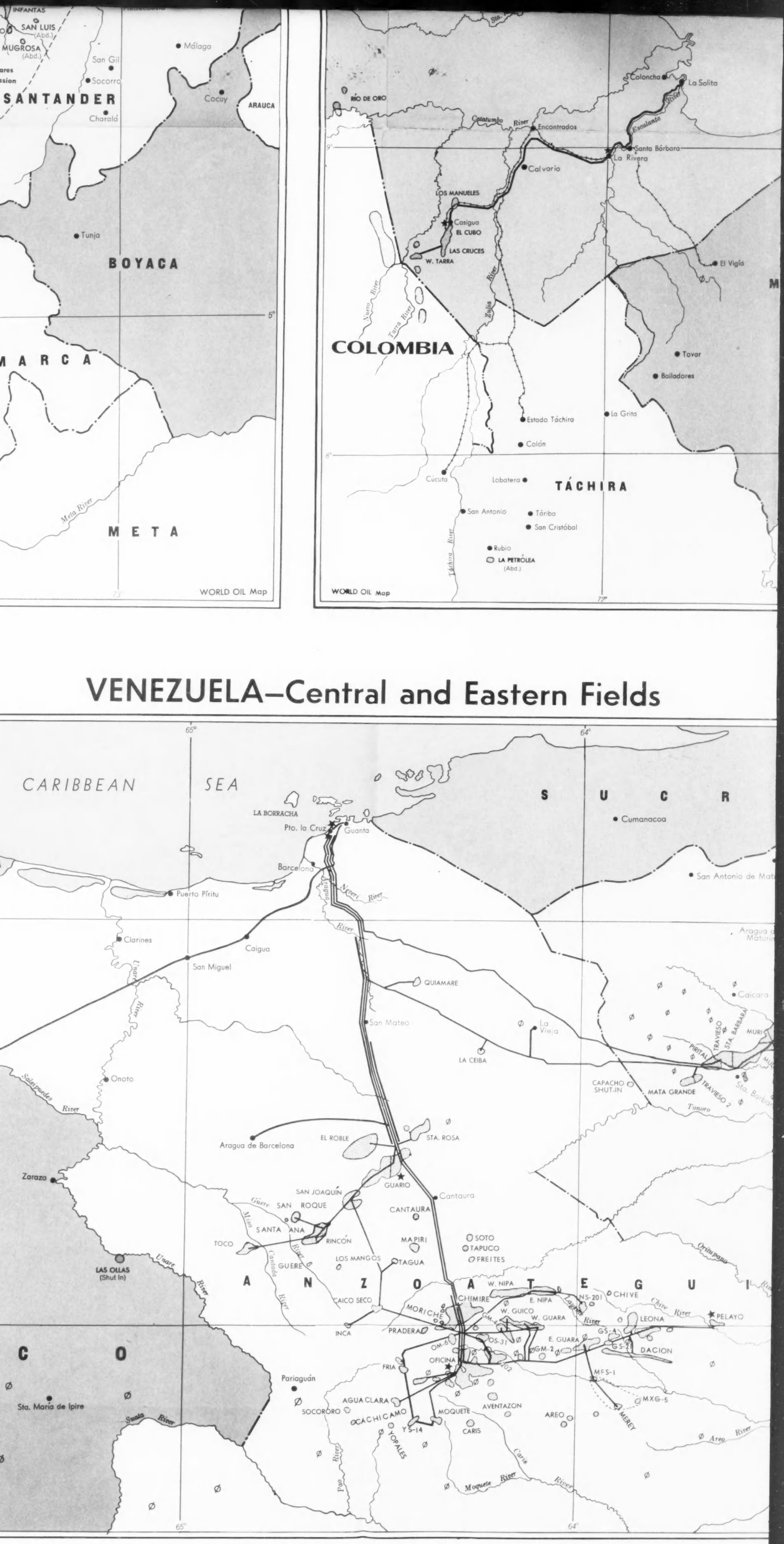
GUARICO

67°

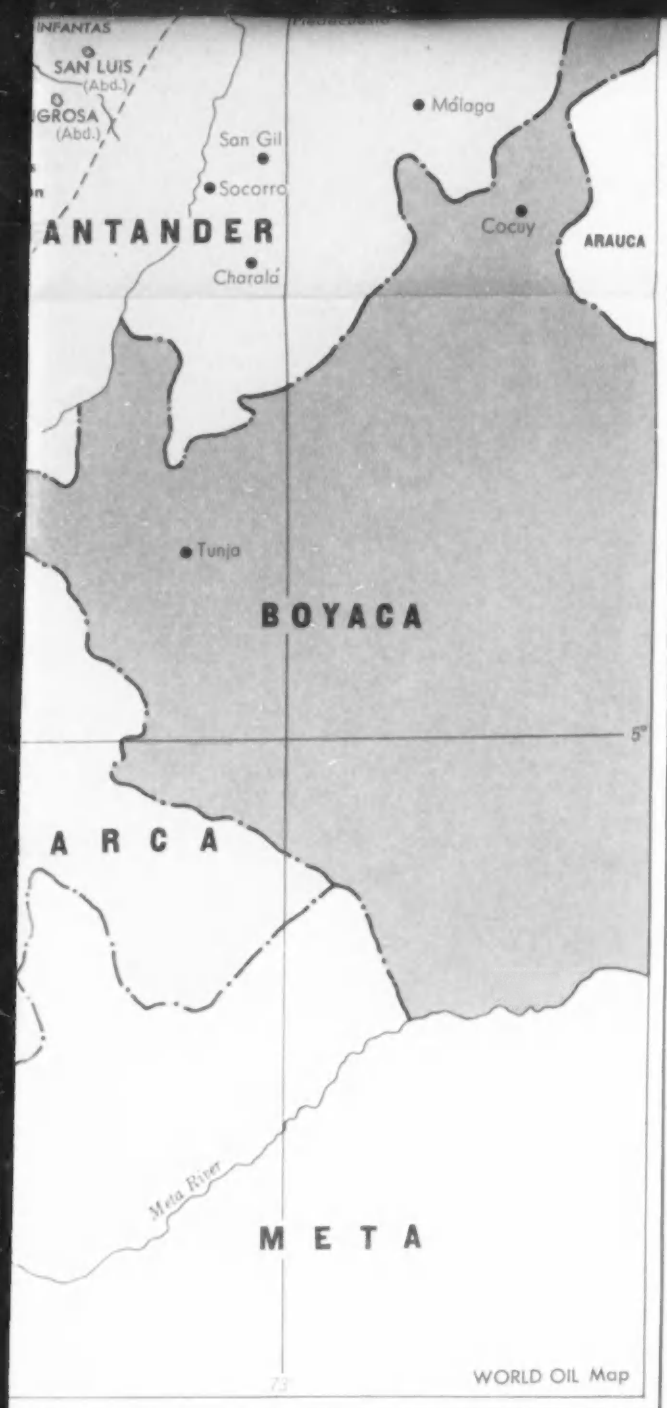
66°

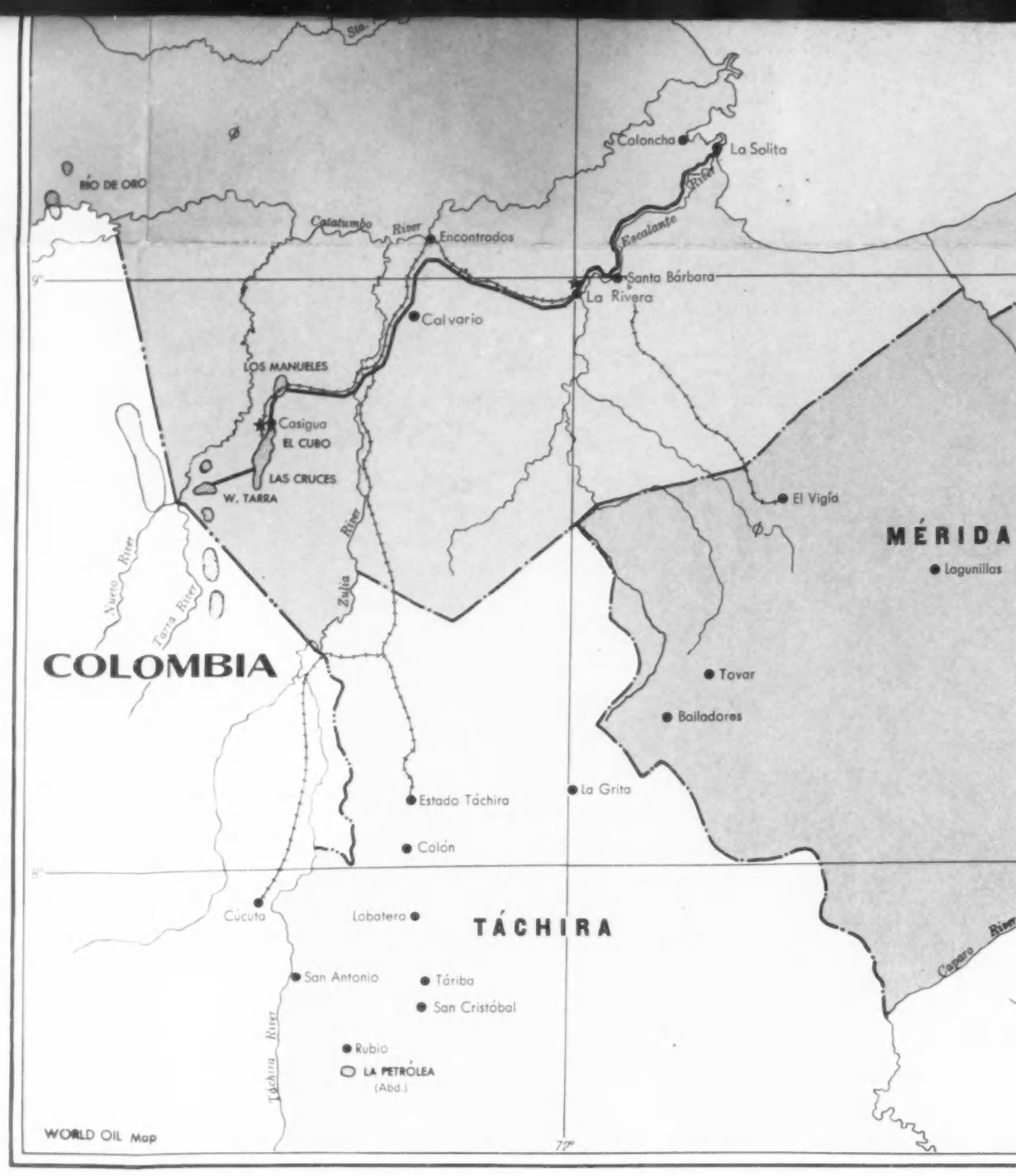
9°

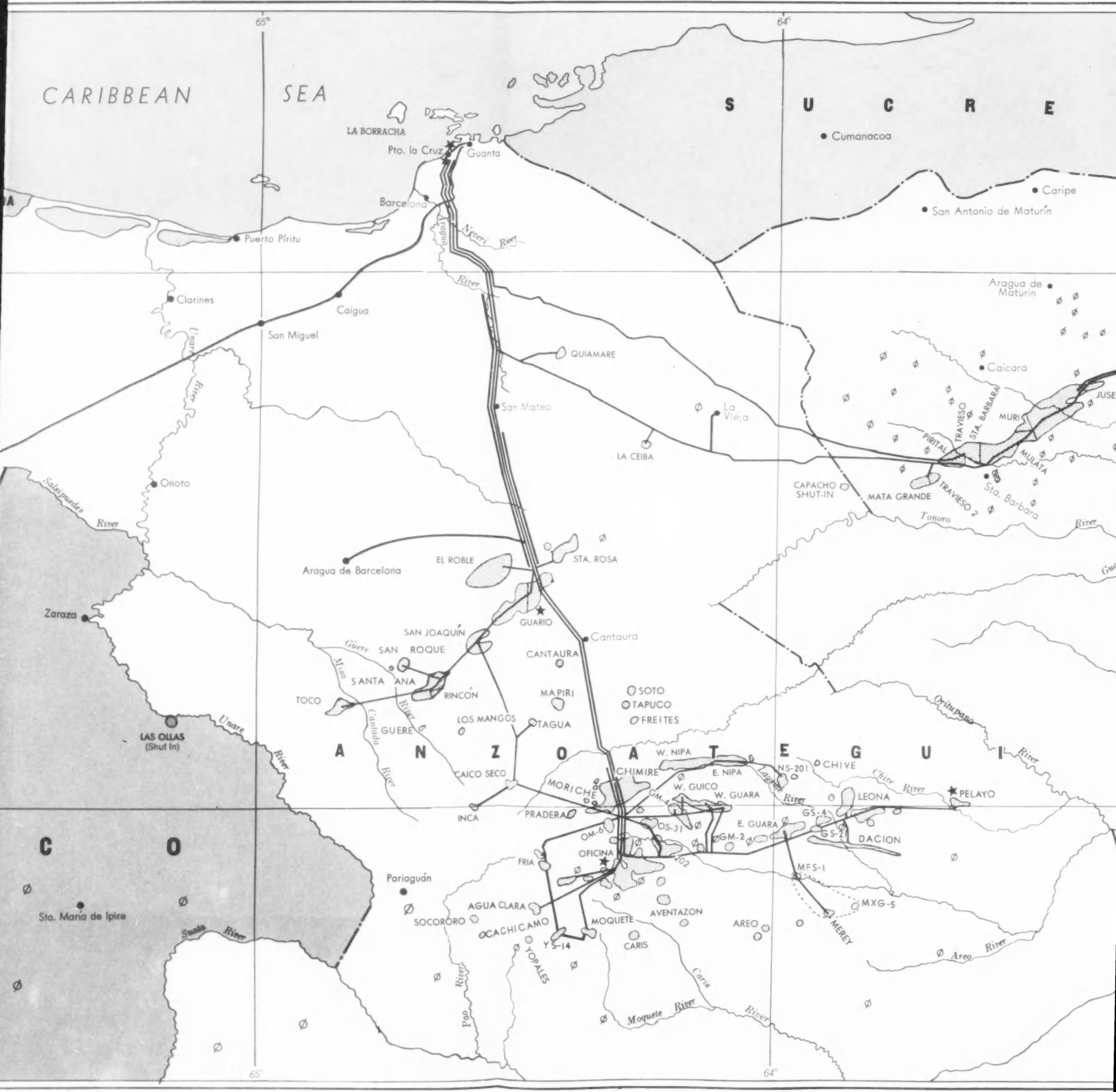
VENEZUELA–Central and Eastern Fields



VENEZUELA—Central and Eastern Fields







TRUJILLO
Motatán
Trujillo
Valera
Bobures
Torondoy River
Torondoy
Timotes
Boconó
Biscucuy
Guanare River
PORTUGUESA
9°
Boconó River
Mucuchies
Barinitas
Barinas
Sub-Domingo River
Mérida
IDA
gunillas
SILVESTRE
Ciudad Bolivia
BARINAS
apara River
Santa Bárbara
Suripa River
Apure River
APURE
Palmarito
71°
70°

OIL FIELDS
Dry Wildcats
Pipe Lines
Refineries
Miles
Kilometers
63°
GULF
OF
PARIA
62°
TRINIDAD
ripe
Caripito
Under Construction
GUANOCO
(Shut In)
San River
COTORRA
VENADO
PEDERNALES
10°
QUIRIQUIRE
Pedernales
REMEDIADORA
Guarapiche River
Angostо River
OROCUAL
MANAMO
JUSEPÍN
Maturín
Guanipa River
Amana River
Manamo River
Pedernales River
Cai-Jarina River
TERRITORIO
DELTA
AMACURO
Guanipa River
River
River
Morichal River
Great
M O N A G A S
Aribi River
Maguarito River
LOS CARITOS
TUCUPITA
Tucupita
Tigre River
URACOA
Tabasca River
Uracoa
9°
TEMBLADOR
TABASCA
Great Morichal River
Uracoa River
PILON
Yabo River
Orinoco River
A WORLD OIL Map
63°
62°